Electrical Review

THE PIONEER ELECTRICAL WEEKLY OF AMERICA.

VOL. XXXVII. No. 19 NEW YORK, WEDNESDAY, NOVEMBER 7, 1900. ISSUED WEEKLY.

ELECTRICAL REVIEW

Park Row Building,
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Subscriptions to the
ELECTRICAL REVIEW.

One Year, United States and Canada, - - - $3.00
One Year, Foreign Countries, - - - - - - 5.00
Single Copies, each, - - - - - - - - .10
Copies can be supplied for only one year back at 25 cents each.

An experiment which will be watched with considerable interest all over the country is the cut in toll rates for local messages just inaugurated by the Chicago telephone companies. Whether the plan is feasible or not depends not so much upon the approval and support of the subscriber as upon the initial and routine expenses of installation and maintainance. The outlay required of the companies by the introduction of this system is enormous, and the support given will have to be more than generous to make it a success, but successful or not it is evidence of pushing enterprise and indomitable pluck and is, therefore, commendable on that account.

ELECTIONS VS. BUSINESS.

It has been a proverb in this country for many years that business proceeds haltingly on the eve of general elections, and that election years are always marked by more or less depression, attendant upon popular interest in political subjects and some uncertainty that may exist as to the permanence of financial conditions. Speaking for the electrical trades it may be said that this year has furnished a brilliant and notable exception. We have just passed through the throes of a hotly-contested national campaign involving great issues. Notwithstanding, at no time for several years past has business been so good, or have trade conditions been better than in the year now drawing to its close. The electrical industry has already begun to feel the tonic influence of foreign markets and the natural results of national expansion. We are beginning to make for ourselves export markets and to look beyond the borders of our own country at an ever-increasing and profitable export trade. While this has been marked, and while no little of the prosperity that has surrounded the electrical industries has been due to an increasing expansion of the market for our electrical manufactures, yet perhaps the greater part of it may be ascribed to the widespread prosperity which has existed at home, notwithstanding the political discussion that has occupied popular attention for several months.

The electrical trades may be said to represent a fair average of business, in that they cater both to the necessities and the luxuries of the population. In seasons of depression it is those branches of industry whose product ministers to the higher refinement of comforts that first feel the pinch of hard times. Even this side of the electrical business has been notably prosperous during the year 1900, while all over the country vast enterprises have been progressing and great sums of capital have been invested in works of engineering development, the building of railways, the installation of new telephone systems, the laying of cables and all the other work that electricity is associated with. Perhaps much of this, if not most of it, has been due to the feeling that existing conditions would not be changed by the events of the election; some of it, and no small proportion, has certainly been caused by the pressure of absolute necessity—or in other words which mean the same thing—by the popular demand for better systems of transit, cheap power and more extended and better telephone service. Another noticeable thing was the apparent lack of interest or "apathy" regarding the political situation. As the election returns have shown, this appearance was not due to lack of interest but rather to the fact that everybody has been too busy to talk politics.

TELEPHONE POSSIBILITIES.

Independent telephony has found no great difficulty in establishing itself in the small cities and towns of the United States, but in a few of the largest cities municipal regulations and the physical difficulties of establishing an elaborate conducting system have hitherto deterred the independent companies from establishing in them exchanges in opposition to the existing telephone companies working under the Bell patents. For some time past much attention has been directed toward various systems of signal wires that are already in existence in these cities, notably those maintained by the various messenger-call companies. These wires have been maintained for many years and, in New York especially, are practically ubiquitous, call-boxes of the American District Telegraph Company being installed in nearly every office of the business district and in most of

the better-class residences and apartment houses throughout the city. The announcement, therefore, that the company operating them is about to replace them with telephones which will, for the present, however, be limited in their service to the transmission of orders to the district offices, will be received with no little interest by telephone men. On another page of this issue will be found an illustrated description of the new telephone call-box and some account of the way in which it will be installed. While the officers of the American District Telegraph Company will not admit that it is even contemplated to introduce an exchange service in connection with these instruments, still one is at liberty to make a guess, and from the very nature of things the guess can not be far wrong. If several thousand telephones are put in on these lines there is little doubt that the clamor for intercommunication which will arise will produce, in the end, its natural result.

The instruments to be installed are not, as they stand, adapted for exchange service, seeing that they have no calling apparatus, but it is noticeable in the design that there is abundant room for the installation of call-bells so that the subscriber can be called to the telephone. The progress of the installation will be watched with deep interest, and no doubt the future plans of the company will be a subject of curious and interested inquiry.

ELECTRO-CHEMISTRY.

No development that has attended the progress of the electric arts has been more rapid, or has produced more astonishing results, than that of the chemical arts dependent upon the action of electricity in forming and dissolving chemical compounds. The work that has been accomplished, while large in volume, has been so little spectacular, and its interest has been confined so entirely to technicians, that little is known of it popularly, yet already its effect has been felt in more than one of the important industries. For example, the electrolytic manufacture of caustic soda has already had a large influence upon the important industrial arts of soap-making and paper-making. The accidental discovery of calcium carbide has given rise to a new and growing industry which has already reached large proportions. The discovery of carborundum has founded a new industry, and it is believed that the electric furnaces will be used, within a short time, in the commercial reduction of certain grades of iron ore. Already, in Italy and in Switzerland, iron is being manufactured in this way with results that are claimed to be excellent. Only recently a new family of substances has been discovered, all of them products of the electric furnace, and several of them promise to take their place as important auxiliaries in industrial work. These are the silicides of calcium, barium, strontium, and other metals of the alkaline earth group. The calcium silicide, when immersed in water, gives off pure hydrogen gas in large quantities, one pound of the solid salt giving nearly nineteen cubic feet of gas. The process of manufacture is so simple and the materials used—sand, quicklime and coke—so cheap, that it is thought that the product may be made on a commercial scale at a very low cost. On account of the strong reducing action exhibited by these compounds it is believed that they will be useful in dyeing and kindred industries. It was not very long ago that electrolytic copper was considered a curiosity, and only a little later that it became a special grade of metal manufactured for special purposes. To-day, the largest proportion of the copper output is electrolytic and quotations are based now upon the price of this class of refined metal. Aluminum, as every one knows, has really been given to the arts by electricity, while such chemicals as chlorate of potash, bleaching powder, and many of the rarer and more expensive drugs are now manufactured almost exclusively by electrolytic processes. It seems safe to predict that another decade will establish the electrochemical industry as one of the most important branches of electrical application.

It is reported in attempting to repair the cable between Galveston and points on the Mexican coast, destroyed in the recent hurricane which devastated the Texan city, that the appearance of the broken end of the cable was strongly suggestive of a submarine earthquake of volcanic action, and it is said that the cable engineers who have the matter in hand incline to the belief that a tidal wave started by some such action was responsible for the inundation of Galveston. Whether this be true or not may be settled when more evidence is at hand, but it is of interest to know that earthquakes are among the greatest enemies to submarine cables. It will be recalled that at one time, not many years ago, Australia was suddenly and completely cut off from the rest of the world by the simultaneous breakage of all the cables connecting it with the northern hemisphere. As days passed into weeks apprehension grew that some sudden war had broken out, and that enemies of the British Empire had cut off the colonies. It was not until the cables were repaired that it was found that earthquakes were responsible for the trouble.

The Automobile Show, at the Madison Square Garden, New York, has opened with every prospect of a brilliant success. The new industry of automobile manufacture has progressed with astonishing rapidity from its inception a few years ago, and the exhibition reflects not only credit upon its management, but also shows in no uncertain way the advance that has been made in the new industry and indicates in some measure the possibilities of progress along many lines in the future.

When Andrew Jackson was elected president of the United States it took some two weeks for the news of his election to reach headquarters at Washington, and some of the outlying districts of the country were not notified of the fact for a month or so afterward. There can be no better illustration of the widespread use of electrical means for transmitting intelligence, and the amazing swiftness with which the news from such a vast district as that embraced by the United States and its territories can be gathered, than that presented by the publication of election returns. The country is, roughly speaking, three thousand miles wide in one dimension and about two-thirds as broad in the other, and yet in five or six hours from the closing of the polls the results of elections held in countless precincts and districts of this enormous territory are gathered and made known, not only at a central point, but the news is transmitted in its fulness back again over the whole great area of the country. A century ago such a performance as that we have just witnessed on the part of the telegraph and telephone companies in gathering and publishing the news of the election would have been regarded as pure witchcraft. To-day it is only one of the many familiar miracles that are constantly being performed by the same agency—electricity.

THE THEORY OF ALTERNATING DYNAMO-ELECTRIC MECHANISMS—II.

BY W. ELWELL GOLDSBOROUGH.

From the above it will be seen that a simple harmonic function repeats itself symmetrically. It is equally true that if two simple sine functions of the same period, but differing in phase and amplitude, be added, their resultant sum will be a simple sine function of the same period. In Fig. 3 let the length of the radius vector (OA) be represented by (A), the length of the vector (OB) by (B) and the length of (OC) by C. The curve (O_1A_1), the equation of which is,—

$$a = A \sin \omega t, \qquad (13)$$

is generated by (OA), the curve (O_2B_2), the equation of which is

$$b = B \sin (\omega t + \Psi) \qquad (14)$$

since the angle $AOB = \Psi$; and the curve O_3C_3, which is obtained by adding the ordinates of corresponding points on (O_1A_1) and (O_2B_2), would be generated by (OC), the resultant of (OA) and (OB), and is expressed by the equation,—

$$c = a + b = A \sin \omega t + B \sin (\omega t + \Psi) \qquad (15)$$

$$= C \sin (\omega t + \phi) \qquad (16)$$

where ϕ = the angle AOC.

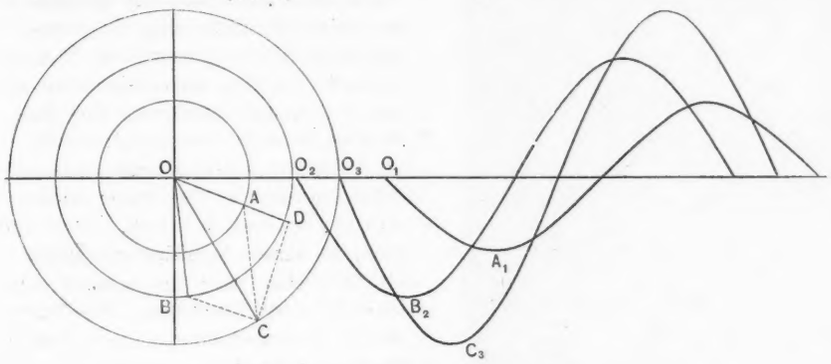


FIG. 3.—ALTERNATING MECHANISMS.

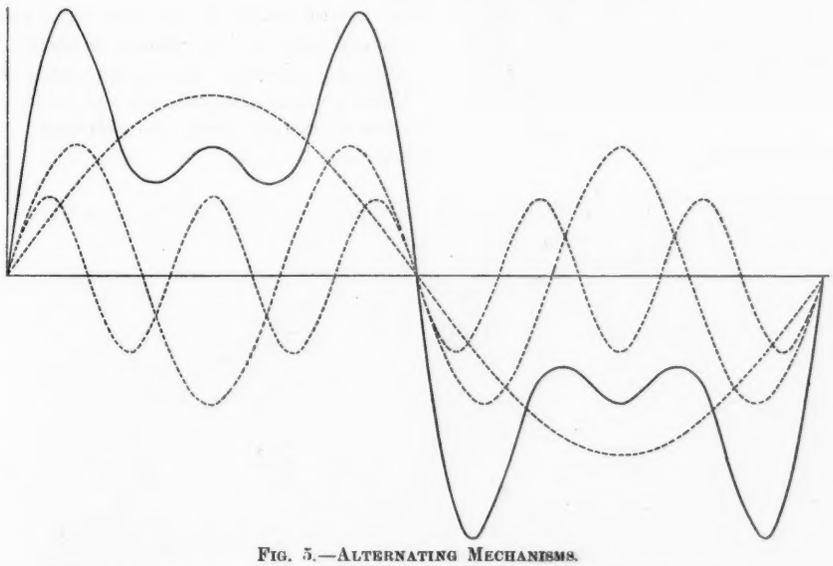


FIG. 5.—ALTERNATING MECHANISMS.

For if we expand $\sin (\omega t + \Psi)$, (14) becomes,—

$$b = B (\sin \omega t \cos \Psi + \cos \omega t \sin \Psi) \qquad (17)$$

and substituting in (15),—

$$c = (A + B \cos \Psi) \sin \omega t + B \sin \Psi \cos \omega t \qquad (18)$$

$$= \sqrt{(A + B \cos \Psi)^2 + (B \sin \Psi)^2}$$

$$\left[\frac{(A + B \cos \Psi)}{\sqrt{(A + B \cos \Psi)^2 + (B \sin \Psi)^2}} \sin \omega t + \frac{(B \sin \Psi)}{\sqrt{(A + B \cos \Psi)^2 + (B \sin \Psi)^2}} \cos \omega t \right]$$

by making,—

$$\cos \Theta = \frac{(A + B \cos \Psi)}{\sqrt{(A + B \cos \Psi)^2 + (B \sin \Psi)^2}}$$

$$= \frac{(A + B \cos \Psi)}{\sqrt{A^2 + 2AB \cos \Psi + B^2 (\cos^2 \Psi + \sin^2 \Psi = 1)}} \qquad (19)$$

and,—

$$\sin \Theta = \frac{(B \sin \Psi)}{\sqrt{A^2 + 2AB \cos \Psi + B^2}} \qquad (20)$$

since:—

$\sin \omega t \cos \Theta + \cos \omega t \sin \Theta = \sin (\omega t + \Theta)$, therefore,

$$c = \sqrt{A^2 + 2AB \cos \Psi + B^2} \sin (\omega t + \Theta) \qquad (21)$$

but from (19) and (20),—

$$\tan \Theta = \frac{(B \sin \Psi)}{(A + B \cos \Psi)} \qquad (22)$$

therefore,—

$$c = \sqrt{A^2 + 2AB \cos \Psi + B^2}$$

$$\sin \left[\omega + \tan^{-1} \frac{(B \sin \Psi)}{(A + B \cos \Psi)} \right] \qquad (23)$$

Now in Fig. 3,—

$$(OC)^2 = (OA + AD)^2 + (DC)^2 \qquad (24)$$

and,—

$$(AC)^2 = (AD)^2 + (DC)^2$$

from the geometry of the construction, therefore,—

$$(DC)^2 = (AC)^2 - (AD)^2$$

and substituting this value of $(DC)^2$ in (24),—

$$(OC)^2 = (OA)^2 + 2(OA)(AD) + (AD)^2 + (AC)^2 - (AD)^2$$

$$= (OA)^2 + 2(OA)(AD) + (AC)^2$$

$$C^2 = A^2 + 2AB \cos \Psi + B^2 \qquad (25)$$

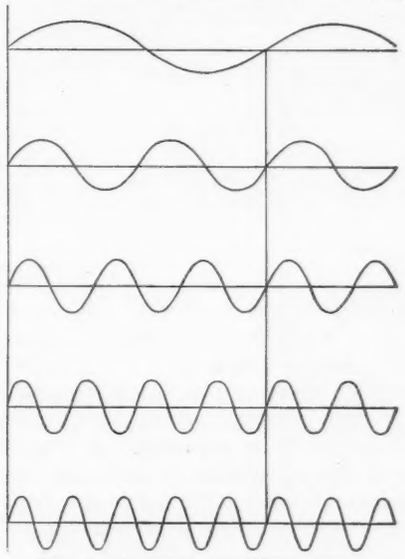


FIG. 4.—ALTERNATING MECHANISMS.

since, OA = A, OB = B, OC = C and AD = B cos Ψ.

Moreover from equation (23) it appears that the resultant of (OA) and (OB) differs in phase from (A) by an angle,—

$$\Theta = \tan^{-1} \frac{(B \sin \Psi)}{(A + B \cos \Psi)}$$

From Fig. 3,—

the angle $AOC = \phi = \tan^{-1} \frac{DC}{OD}$

$$= \tan^{-1} \frac{AC \sin \Psi}{OA + AC \cos \Psi}$$

$$= \tan^{-1} \frac{B \sin \Psi}{A + B \cos \Psi} = \Theta \qquad (26)$$

Therefore, finally,—

$$c = C \sin (\omega t + \phi). \qquad (16)$$

By successively applying this process it can be shown that the resultant of any number of sine functions, having the same period, will be a simple harmonic function of the same period that may be represented by the vector sum of all the vectors of the component harmonics, when drawn to scale in their relative phase positions.

When several sine functions, having varying amplitudes and periods, are combined, the function having the longest period is called the *fundamental* or the *principal function*, and those whose frequencies are two, three, four, five, six, seven, etc., times the frequency of

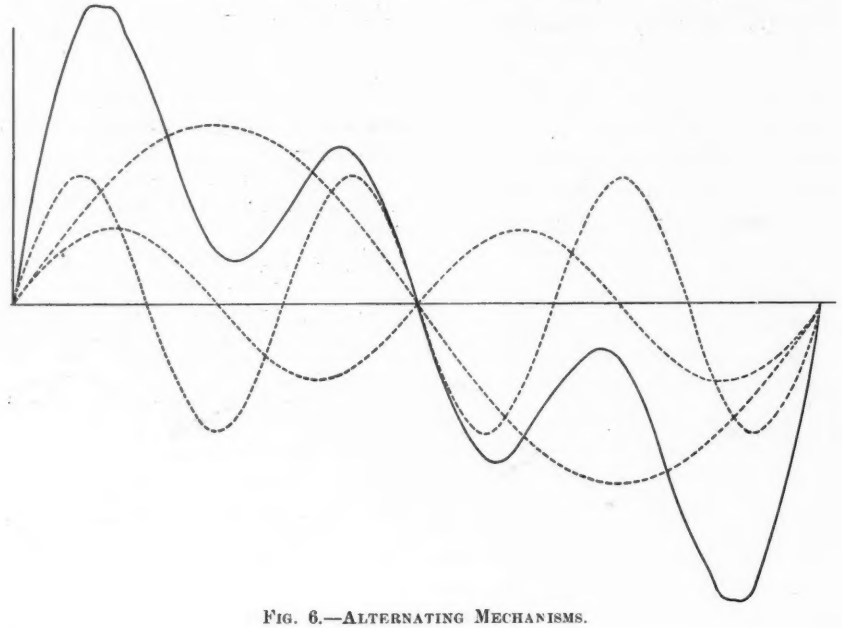


FIG. 6.—ALTERNATING MECHANISMS.

the fundamental are called *harmonics*. To distinguish these harmonics the double frequency is called the second harmonic, the tripple frequency the third harmonic, and so on. A series of harmonics is represented in Fig. 4, with their amplitudes or maximum wave lengths all equal. If a number of simple sine functions whose periods are different but commensurable be added, that is, if the resultant of a fundamental and several of its harmonics be taken, the resultant will be periodic, but not harmonic, and its period will be the least common-multiple of the periods of the several component sine functions.

If this summation should include only odd harmonics as the third, fifth, seventh, etc., the resultant will be symmetrical with regard to the horizontal line, that is to say, the part above the zero line, or the positive wave will be the same as the part below the zero line or the negative wave; but the introduction of a single, even harmonic, such as the second, fourth, sixth or eighth, will produce a dissymmetrical wave, or one in which the positive and negative portions are different or taken in reverse order.

In Fig. 5 the heavy curve is the resultant of the three lighter curves, which are the fundamental and its third and fifth harmonics respectively. Both the positive and negative loops of the resultant start from the zero line at the same inclination.

In Fig. 6 the fifth is changed to the second harmonic. The resultant now rises much more abruptly in the positive than in the negative loop, and is a very dissymmetrical wave. But in practice it is found that alternators do not produce dissymmetrical waves; the most complex waves met with in alternate-current working must be symmetrical about the zero line, no cause being assigned for any difference in shape between the positive and negative waves. This is tantamount to the statement that *no even harmonics, such as the second, fourth, sixth or fiftieth can be expected in waves of electro-motive force or current developed in any practical alternating-current circuit.*

Fig. 7 shows the effect of superposing upon the fundamental wave, a third harmonic having one-fourth its amplitude, the waves starting together from the zero line in the same direction. The resultant curve is symmetrical but very much flattened.

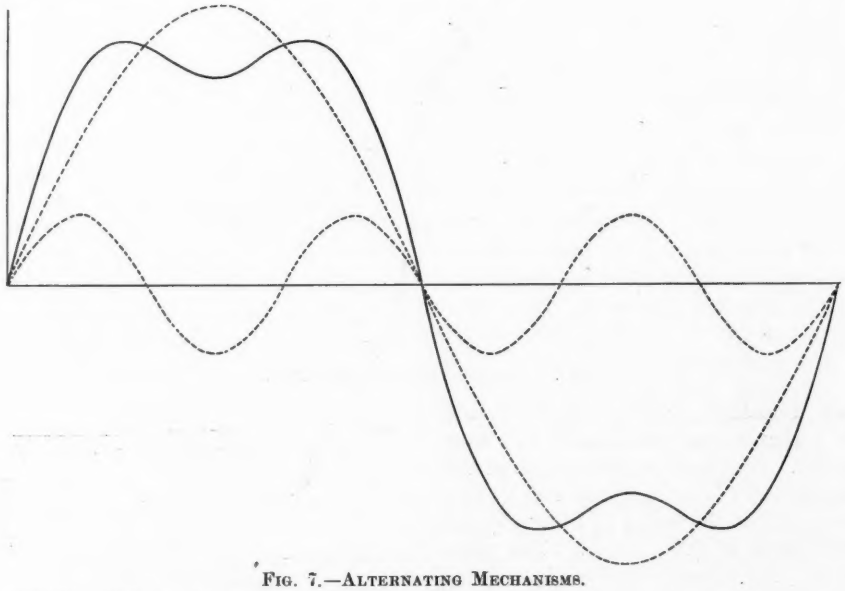


FIG. 7.—ALTERNATING MECHANISMS.

Water-Power in Victoria.

For some time past the question of generating electrical energy by means of waterfalls in the province of Victoria, Australia, has been under discussion and the government geologist, Mr. James Stirling, in his last report, gives a list of the waterfalls available which have come under the notice of the officers connected with the geological survey. This last gives the names, localities and height of the falls that have the greatest drop, which is nearly 1,000 feet. The Yarrow Falls is the largest, and next to it is one on the Dondangabale River, which has a fall of some 400 feet. The other falls range in height from 28 to 100 feet, and though many of the rivers are likely to dry up during the hot season, some of them are constant and can be depended upon to furnish power for all seasons of the year.

It is stated that many of the supply weirs or sluice-ways could easily be adapted for storing up water for generating purposes and already one of them—the Goldbourne—is in use for that purpose. The opportunities for electrical enterprise are more favorable, and as the government is behind the project, it is believed that the proposed system will not only be pushed through within a reasonable length of time, but will meet with considerable success and patronage.

MODERN ELECTRIC CRANES.

ILLUSTRATIONS OF AMERICAN AND FOREIGN PRODUCTS IN TRAVELING AND WORK-SHOP CRANES OF VARIOUS TYPES.

Probably no tool or appliance that is installed in the modern machine shop or electric power station is more valuable than the electric traveling crane, which permits weights within the limit of its capacity to be handled and placed in any part of the portion of space included between its runways and under its beam. It is easy to see that for the operation of such a crane the most exact control of the motive power applied to it is absolutely necessary, and also that this power must be smooth and continuous in its operation so as to avoid jars and shocks which might, in combination with heavy loads, sometimes exceed the safety limit of the crane. No other form of motive power possesses the remarkable ease and flexibility of control, coupled with smoothness of action and simplicity of apparatus, that is exhibited by the electric motor, and for this reason, together with the great ease of transmitting electric power from a stationary generating source to the moving parts of the crane, the electric motor has superseded every other form of power apparatus for this particular application.

The usual form of traveling crane employed in large workshops is well shown in the illustration, Fig. 1, which is a view of one of the main machine shops of the Royal Electric Company, at Montreal, Canada. The crane there shown travels, as the illustration clearly exhibits, along tracks supported upon steel uprights and is controlled by the operator standing in a cage suspended from one end of the deep girders forming the transverse part of the crane mechanism. On top of the girders runs the crab, or transverse moving element of the crane, containing also the hoisting mechanism operating the large hook from which the load is suspended. By this arrangement movement is secured in each of the three dimensions of space and in both directions in each. The crane shown in this illustration is of American manufacture and was built by the Morgan Engineering Company, of Alliance, Ohio.

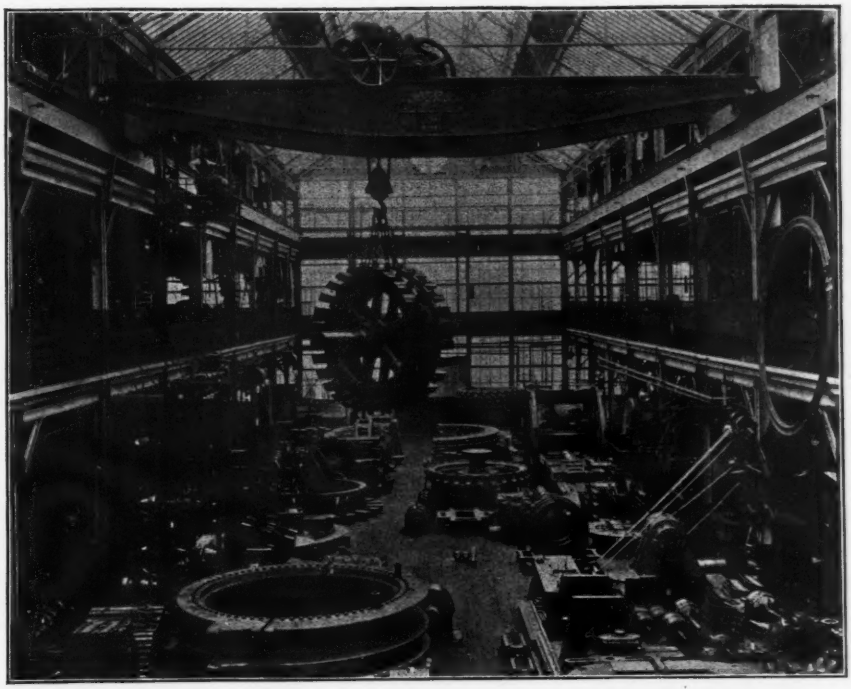


FIG. 1.—ELECTRIC TRAVELING CRANE IN THE ROYAL ELECTRIC COMPANY'S SHOPS AT MONTREAL, CANADA.

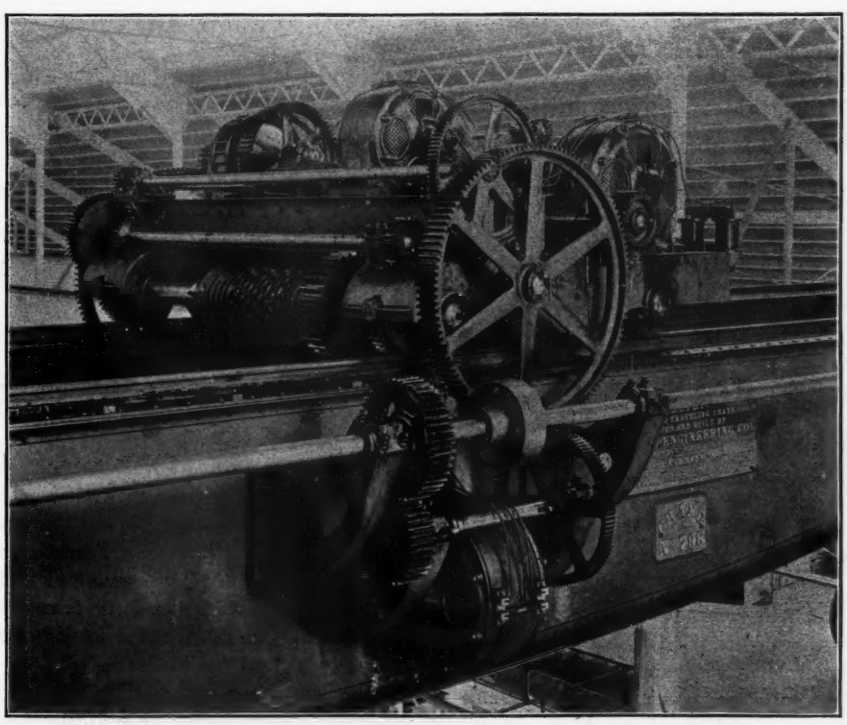


FIG. 2.—A CRANE CRAB WITH TRAVELING AND HOISTING TWO-PHASE MOTORS.

While the direct-current motor is, perhaps, in more general use for crane operation than any other type, still the polyphase motor has many advantages for this class of work, prominent among them being its extraordinary simplicity and freedom from structural weakness which leads to repairs and possible accident. Suspended, as crane motors have to be, in the dust of workshops and exposed to the condensation of moisture and steam upon them, the absence of a commutator in the polyphase type is a great advantage. Fig. 2 gives an excellent idea of a crane crab built by the Morgan Engineering Company and furnished with Westinghouse two-phase induction motors. It will be noticed that three motors are used—one governing the motion of the beam, another propelling the crab along the length of the beam and the third working the hoist. This machine is an excellent type of American crane design. Very different, indeed, from this type of crane is that found on the continent of Europe, two examples of European types being shown in Figs. 3 and 4 on following pages.

In the machinery hall for Germany, England and Belgium, at the Paris Ex-

position, is an electric crane of the gantry type, made and installed by the firm of Carl Flohr, of Berlin. It was used in the installation of the heavy dynamos and engines in this section of the exhibition, and the crane may easily be understood by reference to Fig. 3, which illustrates it at work during the installation of machinery in its section. It will be observed that this crane, instead of running on suspended tracks, goes down to the floor on each side where it runs upon railway tracks. Its high arch spans the great building in which it is installed, and it is seen in the act of lifting a heavy piece of apparatus from the German railway car below. The span of this crane is about 90 feet and its capacity is 25 tons, which may be lifted about 40 feet high. It will be observed that the tops of the upright members at the sides are connected by an arch of steel trellis work, following somewhat the lines of the roof, while horizontal beams extend across and connect the side pieces at the spring of the arch. The base of the crane is built of plate iron and rests upon two strong and heavy carriages, each of which rolls upon four wheels placed tandem. The top of the arch rises to a height of 60 feet from the floor and the horizontal beams are about 45 feet above the ground. To operate this crane three direct-current motors working at 220 volts are used. Twenty-six horse-power is required to move the crane along upon its tracks at the rate of one and one-half feet per second. To hoist the maximum load requires 36 horse-power, when lifting is accomplished at the rate of two inches per second. The transverse movement of the carriage is accomplished by means of a motor of 15 horse-power. The total weight of the motors, carriages and other hoisting and moving apparatus used on this crane is approximately 60,000 pounds, while the total weight of the iron frame of the crane is 150,000 pounds. All control apparatus is located on the platform shown on the left-hand upright in Fig. 3.

In the quarries of St. Triphon, near Aigle, Switzerland, is located the interesting crane shown in Fig. 4. This is used for handling blocks of stone, conveying them to railway cars and loading them for transportation, as is clearly shown in the illustration. This crane is also of the gantry type, but its horizontal beam overhangs the upright members at each end so that the crab may run out beyond them. The capacity of this crane is about 30 tons. The power for operating it is transmitted from the falls of the Grande-Eau River, 36 kilometres (22 miles) away, direct current being used. This plant is highly interesting. Three high-tension direct-current generators of the arc type giving a constant current of 50 amperes are connected in series, each working up to a maximum of 3,500 volts. At the receiving end of the line a transformer station similar to the generating station is installed, in which is a storage battery plant for regulation and power storage. The dynamos are of the well-known Thury type and the plant was installed by the Société des Forces Motrices, of Paris.

ELECTRO-THERAPEUTIC SINS.*

BY REV. H. NEWMAN LAWRENCE.

Sin is the transgression of the law. Therefore electro-therapeutic sins are transgressions of the laws of electro-therapeutics. These laws are many, for they embrace nearly all electrical laws, a large portion of the general therapeutic laws and a number of special laws born of the combination of electricity and therapeutics. Any enumeration of these laws is beyond my province, would occupy too much time, and would partake somewhat of the nature of an insult to my hearers who are well acquainted with them already.

The transgression of these laws may be either wilful or ignorant. Both may be classed as sins and, let me add, that there is such a thing as wilful ignorance and this is perhaps the greatest sin of all.

Although I suppose that I am confined to the title of this paper to scientific sins, yet I can not refrain from mentioning that electro-therapeutic laws are subject to the great moral law of right and wrong. In so far as the large majority of the members of this association are physicians and surgeons, it is manifest that there is no need to say much about transgression of therapeutic laws. The diploma which each possesses from his Alma Mater testifies that he knows the laws; and the high ethical principles which distinguish the profession as a whole are evidence that he does not transgress them.

When, however, the physician or surgeon comes to apply electricity to his therapeutics, the conditions are widely different. His diploma does not cover electrical knowledge. His regular course of instruction either did not teach him electrical laws or only gave him a very meagre and imperfect acquaintance with them.

Herein lies a great temptation to electro-therapeutic sin. Shall he use electricity in his practice without first gaining a reasonably full knowledge of its laws? If he yields to such temptation he is clearly guilty of electro-therapeutic sin. His position would be analagous to a physician who had somehow obtained his diploma without possessing any knowledge of medicinal chemistry and then proceeded to not only prescribe medicines, but also to do his own dispensing. If an electrician presumes to prescribe and apply electricity to the human body when he is ignorant of therapeutics, he at once meets and deserves the condemnation of the medical profession; but granted that he is a bona fide electrician it seems to me a question of fine casuistry as to which is the greater sinner:—the physician who practices electro-therapeutics without knowledge of electricity, or the electrician who practices electro-therapeutics without a knowledge of therapeutics.

When the busy physician finds it necessary to entrust the carrying out of the electrical prescriptions to an assistant, it is very necessary that he exercise due care that such assistant is qualified to carry out his instructions, otherwise, if not actually a sinner himself, he is at least "an accessory before the fact."

Whatever may be said of science in the abstract it is certain that applied science can not be scientific unless that which is applied is measured. Electrical energy can be measured and is moreover sold by certain units of measurement. The laws of electrical measurement are well known so that to apply electricity to therapeutics without measurement is to be guilty of electro-therapeutic sin.

There are other kinds of sins which, though perpetrated under the name electro-therapeutic, are not really electro-therapeutic at all; but inasmuch as they cause great wrong to the public under cover of the name, it may be well to say a few words about them here. Belts and other body appliances bearing the name electric or magnetic and claiming to apply electricity to the body are, with scarce exceptions, frauds, and those persons who sell or recommend them are guilty of electro-therapeutic sin of the grossest kind. That these appliances violate all laws, electric and therapeutic, has been frequently pointed out, but as such exposures seldom get beyond the technical journals the general public can hardly be said to be influenced by them. Still, as attention can not be too strongly drawn to the matter, I will briefly restate the main facts.

A very large proportion of the so-called electric appliances are so badly constructed or so marvelously connected that they can not by any possible chance or mischance produce electric currents. Some bear their own condemnation upon their faces, for they are announced as never wearing out and never requiring renewal.

The only way in which an electric appliance can benefit the body electrically is by producing electrical energy capable of doing work upon the body, in the same way that an electric outfit must produce electric energy capable of doing work upon the bell, *i.e.*, make it ring. There must be a source of energy in the apparatus, and that source requires to be renewed

* A paper read at the annual meeting of the American Electro-Therapeutic Association, New York, September 25, 1900.

from time to time, as the energy produced by it becomes exhausted. In other words, we must have an electric battery, and the electric battery which will never wear out nor run down, as it is called, has yet to be discovered. Science says clearly and definitely that energy can not be created; it may be transformed, changed in character—as from chemical to electrical in the galvanic battery— but it can not be obtained or created from nothing. Any electric appliance, therefore, which professes never to need electrical renewal is a fraud.

Let us take an illustration from the typical electro-magnetic appliance. We have one or two or more strips of magnetized steel sewn into garments or bands, and we are told that the presence of these magnets causes electrical currents to be in the body. Now, while it is quite true that electric currents may be produced in a conductor which is in proximity to a magnet, it is also true that in order to do this one of the two must be moved relatively to the other. Either the magnet must be moved relatively to the conductor or the conductor must be moved relatively to the magnet; without such motion no current can be set up in the conductor. Were it otherwise there would be no need to employ large steam engines, or water wheels or seek the power of Niagara Falls to drive dynamos for the production of large currents for electric light and power purposes. All that would be necessary would be to place magnets near the conducting wires and then to draw off all the electrical energy required. The absurdity of such an idea is apparent to every one, and yet when it is put forward in connection with body appliances many are willing to accept it without question or thought. The body, which is here supposed to be the conductor, when it moves carries the magnet or magnets with it, and there is no relative motion of either one to the other. There is no energy expended in the appliance, and consequently no possibility of any electrical influence upon the body. It would be just as reasonable to place a hammer and nail together and expect the latter to be driven home without any movement of the former *i.e.*, without any expenditure of energy.

While on the subject of electromagnetism it may be well to refer to the fact that magnetism alone has been said to influence the body. Against this assumption (in favor of which not one iota of physiological proof has been ever offered), we have the carefully carried out experiments of Kennelly and Peterson* who, throughout a long series of tests, found not the slightest evidence of physiological action, even when their subjects were placed in very strong magnetic fields.

Further, the startling claims of Dr. Luys, in Paris, as to the curative influence of magnets, were shown by Dr. Hart** to be based upon psychological effects alone, equally good results being obtained from dummy magnets of wood, etc. In fact, the suggestion was everything and the fact nothing.

Other appliances and devices are to be found which differ from the above only in the point that they do not claim magnetic action. They profess in some other way to do electrical work without any pro-

FIG. 3.—THE LARGE GERMAN GANTRY CRANE AT THE PARIS EXPOSITION.— See page 481.)

* New York *Medical Journal*, Dec. 31, 1892.
** *Popular Science Monthly.*

vision for the production of electrical energy, or they are said to act in some hitherto unknown manner, which even their venders do not attempt to explain, but lead the public to suppose the "action" to be electrical, because they use the word electric or electro as a title. An apparatus of this latter type has recently had a large sale both in America and in England. Its venders have never (so far as I know, and I have questioned them myself) attempted to explain the action claimed for it. Nor can they, for the whole idea is an outrage upon the well-known and oft proved laws of physics and physiology. Yet this thing is sold freely at more than a 100 times the cost of its materials and some people who claim to be apostles of light and leading do not hesitate to openly praise and recommend it.

I will pass on to those devices which are, perhaps, even more difficult to deal with because there is a germ of truth in them. I mean those appliances which are capable of producing electrical manifestations under certain conditions. Now, what are the conditions under which electricity may influence the body, *i.e.*, do work upon it? Physiologists tell us that the properties of galvanic or continuous electric currents which can influence the body structures are the electrolytic, the thermal, and the cataphoric-electrolytic, by means of which the fluids of the body are decomposed or broken up into their constituent parts: thermal, by means of which the temperature is raised, either locally or generally; and cataphoric, by means of which substances in solution are passed without chemical change from one part of the circuit to another.

To produce these effects we must have a current which can pass through the body or that portion of it which it is intended to influence. The body offers considerable resistance to the flow of an electric current, and consequently any current must possess a proportionate amount of electric pressure, or electromotive force, as it is called, before it can overcome that resistance, pass into, and do work upon the body. The state of affairs is somewhat similar to that under which a bullet, when simply pressed or thrown against a door, fails to pass through it, but when fired from a pistol, by reason of its velocity or pressure, not only passes through it, but it is capable of doing work on the other side. Going a step further, we may point out that supposing the door to be very thick or have iron sheeting over it, an ordinary pistol would fail to pierce it, but that a bullet from a more powerful gun would easily succeed. For electrical purposes the body may be said to be protected by a semi proof sheeting (the skin), which can only be penetrated by currents possessing considerable pressure on account of the resistance it offers. It would occupy too much time and space to go fully into the consideration of the resistance of the human body. Many authorities have found the value of this resistance under various conditions, but until quite recently no measurements taken under belt conditions had been recorded. Those who have never tried such measurements can not fail to be astonished at the high resistance of the body under these circumstances.

A short time ago I measured it on several people, using for the purpose a belt which had just been purchased at one of the large establishments for the sale of such commodities. The average resistance was 800,000 ohms. As this particular belt had rather small discs, I will assume that the figures may be less with others whose contract discs are larger or differently arranged. Let us be charitable and call it a half, *i. e.*, 400,000 ohms. To pass even the tenth part of one milliampere through such resistance requires (by Ohm's law) 40 volts, and this is at least 40 times more than the best of such belts is capable of. This view of the resistance of the body under the belt conditions has been also proved by Dr. W. S. Hedley,* and by expert evidence given at the famous Harness belt trials which occupied the English law courts at intervals during the Autumn of 1892 and Spring of 1893.**

Such being the resistance, let us see how we arrive at the conclusion that 40 volts is 40 times more than such belts are capable of producing. Every belt which depends upon the moisture of the body for its action can not produce a higher electromotive force—electric pressure—than that of one couple of the elements of which it is composed, because all the elements dip in the same electrolyte (the body moisture), and can not, therefore, be connected in series. There may be many elements, but the fluid of the body can not be separated off into cells. It is all in one containing vessel, so to speak, and the only effect of increasing the number of the couples is to practically increase the size of the plates of similar metal.

An electro-motive force depends only upon the electrical difference between the metals used in the same exciting fluid or electrolyte, it follows that the total electromotive force of these couples, be they few or many, is only that of one couple. The couples used in these belts are nearly always copper and zinc, and their maximum electro-motive force in the presence of such fluids as body moistures is less than one volt.* Other couples may give a slightly different result, but no combination has yet been found which, with such an excitant, will give over one volt.

So far, then, we have an arrangement that may give one volt and which has to act upon a resistance of 400,000 ohms. This by Ohm's law, will give a possible current through the body of one-fourth of a thousandth part of one milliampere, an infinitesimal fraction of the smallest current (one milliampere) recognized by electro-therapeutists; too small for the conception of any but the theoretical mathematician, and less than may be obtained by dipping a needle and a pin in a spot of ink.**

The belt venders sometimes try somewhat to trim their sails to the wind and declare that their devices are only intended to generate small currents, and that their infinitesimal possibilities may prove useful to the body if the time factor is taken into account; that a small electrical influence applied for a long time is equivalent to a greater influence applied for a proportionately shorter time. Imagine having to wear a belt four thousand hours (nearly six months) before the effect of even one milliampere hour could be obtained!

In conclusion, I wish to speak of yet another class of electro-therapeutic sins—*viz:* Testimonial sins. Here the cultured and the educated, outside the medical and electrical circles, are largely to blame; and conspicuous, if not chief, among these sinners are the clergy. We, of the clergy, are bound to make faith one of the chief factors in our teaching and our practice, but it is, or should be, faith in the truth. This for the pulpit, but in practice how often do we find that blind faith is put in all sorts of outlandish things, especially in the nature of body cure-alls, without any effort being made to discover the truth concerning them. In this way some of the vilest electrical quackery has received not only the approval but also the public recommendation of men whose position as ministers of the Gospel gives them considerable influence over suffering humanity. Surely the clergy above all others should avoid this sin, remembering that "blind unbelief is sure to err," and that scientific truth should be sought for and can always be found.

* *Provincial Medical Journal.*
** ELECTRICAL REVIEW.

* ELECTRICAL REVIEW.
** Ibid.

EXPERIMENTS OF J. J. THOMSON ON THE STRUCTURE OF THE ATOM.*

BY CHARLES A. PERKINS.

Recent ideas as to the stability of the chemical molecule have been much modified by the evidence that it is readily dissociated when a substance is dissolved in water.

The researches now being carried on by J. J. Thomson and his assistants on the electrical conduction of gases seem to require an even more radical and sweeping change in our conception of the structure of the atom itself.

Ordinary gases are perfect non-conductors of electricity of low electro-motive force. Electricity may, however, pass through them, more or less readily, under certain conditions, *viz.:*

1. When the electro-motive force is sufficient to produce a spark.

2. When the pressure of the gas is much reduced and a sufficient electro-motive force is applied, as in a "vacuum tube."

3. When the gas is heated very hot, or has been recently in violent chemical activity, as in the region above a flame.

4. When the negative electrode is illuminated by ultra-violet light.

5. When the gas has been very recently exposed to Rœntgen rays or to the similar rays proceeding from uranium, radium, etc.

*From *Science*.

Thomson's investigations on the conduction by sparks through gases at ordinary pressures, indicate that electrolysis took place somewhat as in solutions, and that the amount of decomposition was, in several cases, essentially the same as in the decomposition of solutions. In the case of hot gases and the gases in a vacuum tube, also there was evidence that the conduction was by means of "ions" or portions of broken-down molecules which acted as carriers for the current.

When an electric current passes through a solution, it is a fundamental law that a univalent atom of any substance carries precisely the same charge as a univalent atom of any other substance, while a bivalent atom carries just twice this charge. The exact charge carried by one atom can not be known until we know the exact weight of the atom; but the charge carried by one gramme of atoms ($e|m$) is about 10,000 units in the case of hydrogen. For any other univalent substance, the weight required to carry this charge is greater in proportion as its atoms are heavier than those of hydrogen.

Thomson has undertaken to find the charge carried by the gaseous ion as follows: When the discharge of an induction coil is sent through a vacuum tube, there is seen a luminous glow, stretching in a straight line from the electrode to the wall of the tube. This glow, called the "cathode ray," would seem to be a stream of negatively charged particles, from the cathode, or negative terminal in the tube, projected in a straight line until some solid obstacle is encountered. This cathode ray, when it meets the tube, or any body in its path, may produce fluorescence; it always produces heating, it also excites the vibrations called by Rœntgen the X-ray.

A magnet held near the cathode ray draws it to one side, as if it were a conductor carrying an electric current. Professor Thomson has made use of this property to determine the ratio $e|m$ for the electrified particles. Of course, the more strongly the flying particles are charged, the more they will be drawn aside from their rectilinear path, while the heavier the particles, the more nearly would their inertia keep them in a straight line. The ratio of the charge to the mass of a particle determines its velocity at right angles to the original direction.

Again, the flying stream may be drawn aside from its course by an electrified plate at the side of the stream, by which it will be attracted or repelled according as the plate has a positive or negative charge.

Both these methods for deflecting the ray were employed. The energy of the flying particles was also determined from the heat which they produced when directed upon a thermopile; and the ratio of the

FIG. 4.—A SWISS ELECTRIC TRAVELING CRANE AT WORK IN A MARBLE QUARRY.—(See page 481.)

charge upon the particles to their mass was thus found to be about 10^7, or nearly 1,000 times as large as for the hydrogen atom in the electrolysis of solutions.

Again, when ultra-violet light falls upon an amalgamated zinc plate, the gas near the plate becomes conducting. Here, again, if a magnetic field is produced near the plate, the path of the charged particles is changed. This path can no longer be seen, as in the cathode ray; it may, however, be inferred from the change of conduction, when the distance between the electrodes is varied. The ratio of the charge to the mass of the particles is, in this case, the same as in the cathode ray, as above determined.

If, as is believed, the electric current in these cases consists of a stream of charged particles, we are apparently shut up to the alternative that the charge of each ion is 1,000 times as great as is found in solutions, or that the mass of the ions is $\frac{1}{1000}$ as great as that of the hydrogen atom. Probably the former supposition seems much less opposed to our preconceived ideas than the latter, but it is a question to be decided by experiment rather than by preconceived ideas.

To make a direct measurement of the mass of the single ions, or particles taking part in electric conduction. Thomson examined air which had been rendered conducting by exposure to Rœntgen rays. The quantity of electricity carried by such air is measured without special difficulty. To count the number of ions taking part in the conduction is quite another matter. This counting has, however, been actually accomplished in the following manner: Damp air, which has been freed from dust by filtering, is exposed to the Rœntgen rays and its conductivity determined; it is then suddenly expanded to one and one-third times its volume. The expansion and consequent cooling causes a fine fog or mist to form. It has been found that when such a mist is formed, there is at the centre of each drop, a minute particle of dust or other substance upon which condensation has taken place. In this case, all the dust had been filtered out, but the charged ions performed the same duty of allowing condensation to begin, and hence the number of water drops is the same as the number of ions present in the air. To count the number of drops, the weight of the cloud is determined by a sensitive balance. They are also allowed to settle in a bell jar, and the rate of settling is observed. The calculations of Stokes, based upon the viscosity of air, show at what rate drops of different size will fall, and from this, the size of the water drops is determined. The size of the drops and the weight of the cloud give the total number of drops in the cloud, and hence the number of ions present in the air.

The result of this experiment turns out to be that the number of ions, carrying a unit quantity of electricity is perhaps a little less, certainly not very different, from the number carrying a unit quantity in the case of solutions. The other alternative seems to be the true one, that the mass of each ion (or "corpuscle," as Thomson calls them) has about $\frac{1}{1000}$ the mass of the hydrogen atom. More than this, it seems to be the same for all the gases tried, instead of differing with their atomic weight, indicating that all these gases give off corpuscles of the same mass.

These results, revolutionary as they are, fit in well with some other facts. Thus, the stream of electrified particles constituting the cathode ray, is found to penetrate a mass of air much farther than would be expected if the ray were composed of particles as large as atoms, but just about as far as if they were $\frac{1}{1000}$ as large as hydrogen atoms. They also penetrate all gases in the inverse ratio of their densities. However, if the reason for this is to be found in the fact that their molecules are all built up of corpuscles of the same kind, it must also be true that the structure of the molecules is extremely porous, allowing the corpuscles to pass through them with great freedom.

Further confirmation of this theory is found in a recent discovery by Zeeman in spectrum analysis. When a luminous gas is between the poles of an electromagnet, the lines of its spectrum are found to be affected in such wise as to indicate that the particles whose vibrations produce the light are electrified; and the ratio of the charge to the mass of the particles is found to be the same as for Thomson's "corpuscles." Mendelèef, who has grouped the chemical elements into a remarkable series of families, says "the periodic law, together with the the revelations of spectrum analysis, have contributed again to revive an old, but remarkably long-lived hope, that of discovering . . . the primary matter, which had its genesis in the minds of the Grecian philosophers, and has been transmitted, together with many other ideas of the classic period, to the heirs of their civilization." "From the failures of so many attempts at finding in experiment and speculation, a proof of the compound character of the elements, and of the existence of primordial matter, it is evident, in my opinion, that this theory must be classed among mere Utopias."

It would seem that a beginning has been made in attaining this Utopia. The theory is too new and too extreme to have received the scrutiny and the criticism which it deserves. It yet remains to be seen whether it is consistent with the low internal energy of gaseous molecules, or whether it will prove valuable in explaining the electrical, magnetic or chemical properties of bodies. Its author has already published a number of suggestive "speculations" as to the part played by corpuscles in electrical and heat conduction, in the Thomson effect, in the magnetism of rotating matter (terrestrial magnetism?) and in a number of the other electrical properties of bodies, which at least indicate some of the possibilities of the new theory in the domain of molecular physics.

Automobiles

A recent arrival at Vancouver, B. C., is M. Nez de la Mar, a Frenchman, who attempted to ride from Skagway to Dawson City in an automobile. They say de la Mar is returning to France bringing with him, as a souvenir, a $900 nugget from one of his gold claims in the Klondike.

A freight line, to be operated by electromobiles, is soon to be established in California between Los Angeles, Pomonte, Ontario and Cheno to replace a large horse truck, which, for some years past, has been used to convey merchandise to those towns from the capital. It is stated that the automobile truck which is to be used will be a 40-horse-power machine, capable of hauling 10 tons at the rate of from three to five miles an hour and capable of increasing its speed, if necessary, to eight miles. The first trip is to be made within a few days.

The French papers state that the Touring Club of France is engaged in the compilation of a card showing all the electric stations in France at which automobiles may be recharged. The club has also requested persons only in electrical installations to state the nature of the current produced, whether constant or alternating, if continuous, what voltage it has. It is also asked whether the owners will permit automobiles to be charged, how many amperes of current they are willing to sell, at what hours, and if ampere and voltmeters and suitable rheostats are in their possession. When this tabulation is finished, it will be of great service to all of the automobile tourists in France—and their name is legion—as in many cases it is impossible to recharge the accumulators of the machine from regular public authorities or authorized electric light or power companies, while it is thought that many of the manufacturers will be perfectly willing to sell their power at a reasonable figure.

THE AUTOMOBILE SHOW AT MADISON SQUARE GARDEN, NEW YORK CITY.

FINE EXHIBITS OF ELECTRIC AND OTHER AUTOMOBILE VEHICLES—EXHIBITS AND EXHIBITORS—FOREIGN AND AMERICAN VEHICLES.

The exhibition of automobiles and their accessories held under the auspices of the Automobile Club of America, opened at Madison Square Garden, New York city, on Saturday night, November 3. For the first night of a show of this sort a very good crowd was in attendance and the exhibits were well received, the Garden itself presenting a very gay appearance, being tastefully decorated. Although on Saturday night many of the exhibits were unfinished and several of the stalls empty, the show promises well and it is expected that in a very short time such progress will have been made as to make the affair complete and satisfactory in every respect. The track surrounding the exhibits on the main floor of the Garden was rough and uneven, causing the vehicles which were being sent around to bump considerably and rendering high speeds impossible.

Entering the Garden the view presented is of a circle containing the large exhibits in the centre of the main floor with a gallery on the west and northwest sides containing the exhibits of such manufacturers as make tires, lamps, parts, etc., and at the extreme left of the gallery the automobile newspaper booths. Among the conspicuous exhibits are those of the De Dion-Bouton "Motorette" Company, Panhard et Levassor, the "Mobile" Company, the Winton Motor Carriage Company, the Ohio Automobile Company, the Riker Electric Motor Company, the Automobile Company of America, the Electric Vehicle Company, and many others of equal importance.

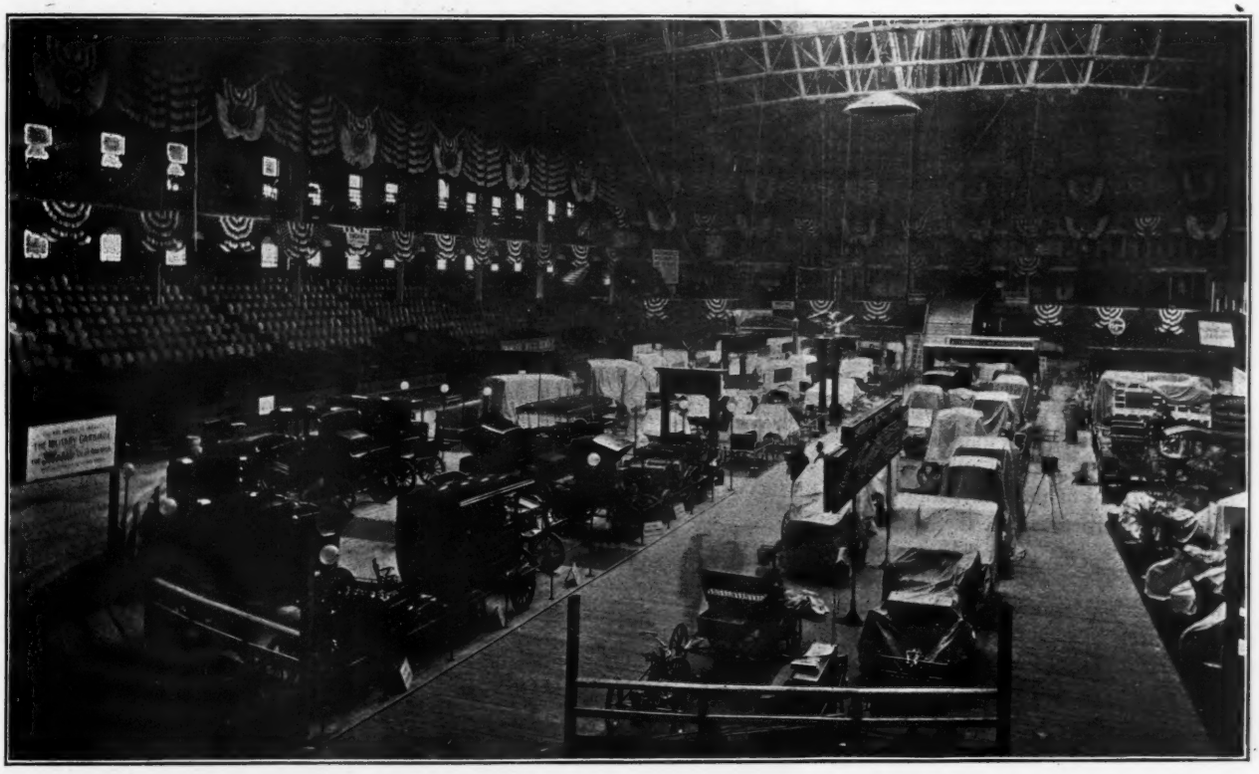
The exhibit of the Electric Vehicle Company, which manufactures the Columbia automobiles, was of great interest, showing, as it did, 19 different styles of conveyances, conspicuous among which were delivery wagons, wagonettes, cabs, omnibuses, broughams, surreys, runabouts and victorias. The general style of the vehicles is solid and they seem heavily constructed, but are not so built as to interfere either with ease of manipulation or running speed. The company's rear-boot victoria is a handsome vehicle finished in black and giving evidence of the workmen's skill in design and execution. The runabouts, phaetons and victorias are, of course, not so heavy as the larger vehicles, embodying graceful lines with good seating capacity.

In section F, at the left side of the entrance to the Garden, is the exhibit of the Automobile Company of America, showing a number of electric vehicles, among which are two standard phaetons and a delivery wagon. Another machine of this company's manufacture is similar in design to the phaetons and is finished in white enamel with tan seats and silver trimmings, presenting a very striking appearance.

At the left side on the main aisle on the ground floor is the space allotted to the Riker Electric Motor Company. The vehicles in this section are all finished in dark colors and among them are theatre omnibuses, cabs and cabriolets.

In the exhibit of the De Dion-Bouton "Motorette" Company, on the ground floor, is seen the already famous type of road-racing machine by which this company is so well known, and below stairs, in the southwest corner of the Garden, is the electric tricycle which won the 900-mile French race recently. A curious feature in connection with this exhibit is that directly opposite to this modern machine with its speed of 49 miles an hour (which may be increased for an hour's run if desirable) stands the old steam omnibus built in 1854 by Mr. Dudgeon, of Long Island. The contrast is so striking that visitors were impressed with the tremendous strides made in the automobile industry during the past 30 years.

Next to the De Dion-Bouton exhibit was that of Panhard et Levassor, who showed their famous road wagon, and alongside



A General View of the Automobile Show at Madison Square Garden, New York City.

of it was a steam velocipede made by a Mr. Austin, in 1860. This also excited considerable comment and provoked amusement at the expense of the antiquated vehicle, while at the same time it drew more than ordinary attention to the speedy French machine standing just back of it.

Returning to the main floor and proceeding to the left side of the entrance may be seen the low, rakish-looking road wagon manufactured by the Winton Motor Carriage Company, a type of vehicle which has established the reputation of this company for speed and facility. Small though it is it possesses speed and endurance and is well calculated from its size and build to meet the requirements of those who wish to obtain speed, facility of movement and simplicity in design.

The exhibit of the "Mobile" Company of America filled the entire roof garden and among the vehicles shown was the new military "mobile" which is designed to carry a thousand rounds of ammunition, four men, three days' rations, blankets and rubber shelters. The machine will cover 100 miles a day over average country roads or ordinary prairie land.

The Ohio Automobile Company on the ground floor showed several types of road wagons equipped with gasoline motors, all of them being tasteful in design and apparently comfortable vehicles in which to travel, the finish being neat and the design compact.

The withdrawal of the chairman of the exhibition committee, Mr. A. R. Shattuck, who is also president of the Automobile Club of America, was a serious blow to the management, inasmuch as Mr. Shattuck has been tireless in his efforts to make the affair a success.

In the gallery, which has been built around the northwest side of the building, extending into the regular gallery on the west, are the exhibits of many of the prominent rubber, lamp, part, bell and fixture manufacturers, noticeable among which are the displays of the Goodrich Rubber Company, the Rose Manufacturing Company, makers of the "Never-out" lamp, the Diamond Rubber Company, Shelby Steel Tube Company, and the Goodyear Tire and Rubber Company.

Taken altogether the show promises well and judging from the attendance on Saturday night and the reception which was given to the various companies which had machines and appliances on exhibition it is expected that the affair will be a very successful one and prove the incentive needed to stimulate the industry.

A very considerable amount of fine catalogue and other pertinent automobile literature is being distributed by the exhibitors, the work in nearly every instance being from the presses of Bartlett & Company, of New York. The catalogues are of the high class and character usual with this house, and are appreciated by the visitors who noticeably carry them away for preservation.

Society turned out in force on Monday night and hundreds of people prominent in New York society circles were in evidence, thronging the spacious Garden with kaleidoscopic changes of handsome gowns and headgear.

Interest was chiefly centred in the machines themselves, there being little or none of the usual cheap attractions to be ordinarily expected at such affairs, the visitors being gravely curious as to the merits of the respective vehicles and asking generally only such questions as indicated their desire for authentic information with a view to purchase.

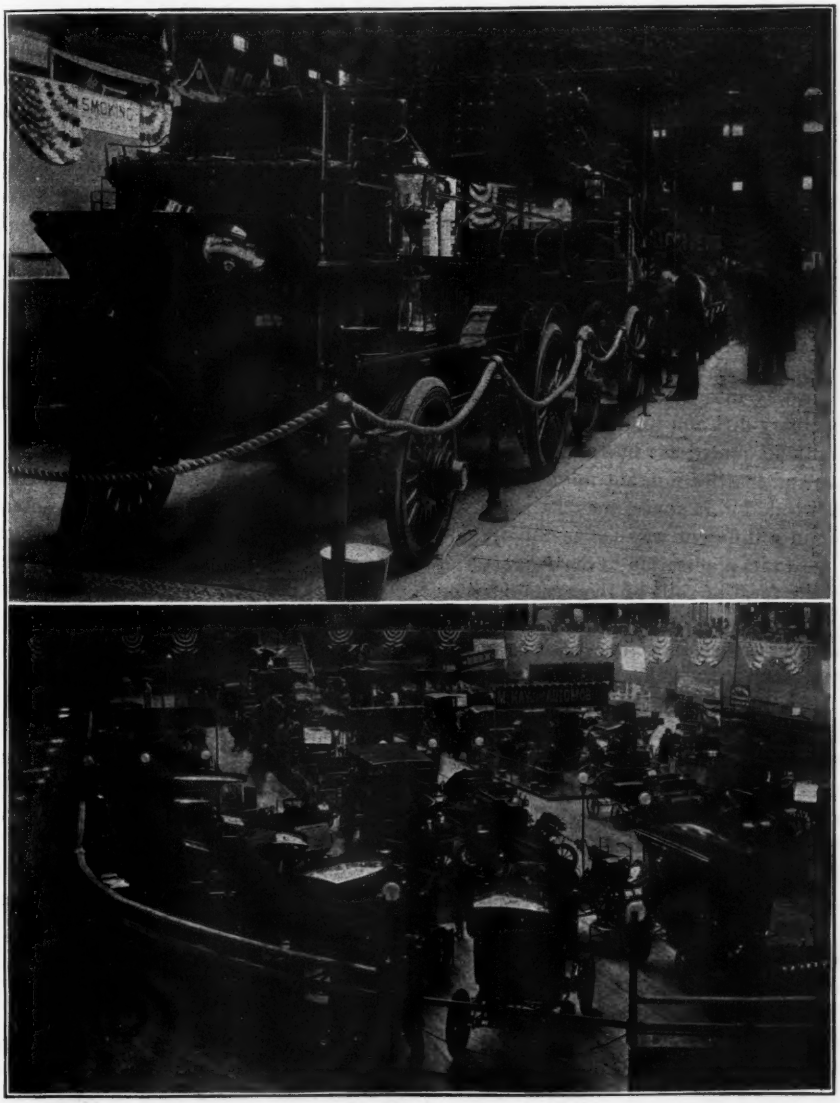
The first of the contests was held on Monday night. This was the obstacle race which was followed on Tuesday afternoon by an exhibition of grade climbing on the track laid on the roof and up the side of the tower. The obstacle race had four entries and was won by Mr. Walter C. Baker, Mr. Edward Adams, second. Time, 25 seconds. In the climbing contest, grades of 35, 35½ and 40 per cent had to be surmounted, and this was cleverly accomplished by Mr. Joseph McDuffie, who made one of his trips in 40 seconds flat, shooting his machine up the narrow track at hair-raising speed. On reaching the level at the top of the 40 per cent grade, which was the highest, the daring *chauffeur* paused for a brief moment and then skilfully backed his machine down to the more solid plane of the roof.

It is stated by the exhibitors that they expect to make many sales and express themselves as being very well satisfied so far with the reception which has been accorded their efforts.

EXHIBITS OF THE AMERICAN BICYCLE COMPANY AND THE DE DION-BOUTON MOTORETTE COMPANY AT THE AUTOMOBILE SHOW, MADISON SQUARE GARDEN, NEW YORK CITY.

Views, News and Interviews

"What Governor Northen, of Georgia, says about the value of technical education to young men reminds me of a curious little story," remarked a steamship agent of New Orleans, to a *Times-Democrat* reporter. "I can tell it without injuring anybody at present, as the chief actor is now comfortably located in the North. He was a young Louisianian—call him John Smith for the purpose of the yarn—who drifted down to one of the Latin-American countries several years ago, looking for a chance to 'catch on.' Nothing presented itself, and he was getting desperate, when the authorities of a certain good-sized town determined to install an electric light plant and also to see what could be done toward utilizing an adjacent water power. They wanted to send an expert to this country to get the necessary machinery, but had nobody in sight competent to undertake the task, and young Smith promptly jumped into the breach and introduced himself as a high-class electrical engineer. As a matter of fact he didn't know an electric current from a brandied cherry, but he had to have a job, and, to make a long story short, he was engaged on the spot. Now comes the remarkable part of it. He sailed North on the next steamer, and as soon as he arrived at New York he immediately entered a technical school for a course in electrical engineering. Then he also entered a night school for the same line of instruction, thus doing double work. Luckily he had the constitution of a horse, so he stood the strain without breaking down, and in a month's time he had a sufficient working knowledge of the profession to enable him to attend to his errand intelligently. He made an excellent deal, and on his return brought back a small library for the continuance of his studies. He is regarded at present as one of the rising young engineers of the day."



EXHIBITS OF THE RIKER MOTOR VEHICLE COMPANY AND THE ELECTRIC VEHICLE COMPANY AT THE AUTOMOBILE SHOW, MADISON SQUARE GARDEN, NEW YORK CITY.

The city electrician of Cincinnati, Ohio, has asked the local authorities to compel the Edison company to place its poles on private property instead of along the public streets; that all wires be so strung as to clear the trees, be especially insulated and that the permission to set the poles be held up until the board of public service receives samples of the wires to be used. The reason for these requests is the fact that the application does not conform with the city's ordinance, which does not specify the exact location for the poles.

On Saturday afternoon, October 27, an enthusiastic crowd of the students, professors and friends of the University of Michigan gathered in the gymnasium at Ann Arbor to get the returns of the football game between their team and that of the University of Illinois. Mr. Edward D. Trowbridge, general superintendent of the Michigan Telephone Company's long-distance service, and Mr. F. J. Keech, of the city lines, tendered the free use of their wires, which was gratefully accepted and enabled the audience in the gymnasium to follow the game move for move. This is the first time that the telephone wire has been used to such advantage for such a purpose and much credit is due Mr. Trowbridge, by whose personal effort the scheme was made possible.

A somewhat facetious steam railroad journal refers in a humorous way to a recent rear-end collision which occurred on a western electric line, and says: "The electric railroads are constantly introducing greater variety into their accident records, being determined, apparently, to match the steam railroads in every feature of operation which will make things interesting for the passengers. The latest novelty reported in the newspapers is a rear collision due to a break-in-two. This was on a line between Chicago and Evanston. A pin holding the coupling between a motor car and a trailer was in some unknown manner dislodged, and the trailer fell back some 300 feet before anyone noticed the separation; then a passenger pulled the bellcord and the foremost car was promptly brought to a stop. The trailer kept on and five persons were injured, and there was a small panic among the uninjured."

SOME INTERESTING FAULTS MET WITH IN CABLE MANUFACTURE.*

BY J. WRIGHT.

A fault, whatever its nature, is at all times abhorrent to the electrician in charge of a network, but becomes more or less an object of interest when its position has been correctly localized, from the point of view indicated by cause, effect, and future prevention. In no branch of the profession are a greater variety of faults and their causes to be met with than in that of cable manufacture pure and simple; such faults arising, in process of manufacture, from carelessness on the part of the operatives, inadaptability of machinery to a specific purpose, or other unforseen circumstances.

It is with the object of interesting the reader, and at the same time exhibiting the difficulties which the much-maligned and long-suffering manufacturer has perforce to contend with, that the following paragraphs have been written.

In gutta-percha insulated wires and cables, the faults most commonly met with are due to foreign matter and impurities in the insulating medium. Both rubber and gutta-percha, in the raw state, are essentially impure, owing to the local conditions governing their collection. For this reason they have perforce to undergo an exhaustive series of purifying processes before their final application to the cable of wire which they are intended to insulate, such as repeated washings in several waters, mastication, sieving through a gradually increasing mesh, etc.; but despite these precautions, impurities will often find their way into the final result with disastrous effect. Cleanliness and care are essential in cable manufacture; the presence of any foreign matter, especially in gutta-percha, will make itself evident in the final tests, however slight its proportion to the total mass of insulation. Such faults as these, due to impurities, are seldom found by inspection, to a rigorous system of which most core is subjected in its unfinished state, with the single exception of gutta-percha core, which, by its homogeneity of texture and monotone tint, readily lends itself to a minute visual inspection, which, with practice and experience as exemplified in some of the old hands in the trade, serves to eradicate most of the faults due to this cause. The remainder have to be localized electrically, to which end there are many systems, all more or less suitable according to local circumstances, and which lend themselves, in the majority of cases, to actual spot localization.

*From the London Electrical Review.

Among the many impurities which find their way into rubber and gutta-percha compounds are wood, fibre, dirt, splinters of metal, mineral matter, etc., all of which by their presence in the mass of the insulating sheath, tend to reduce its thickness, and in many cases, form a direct conducting path from the conductor proper to the exterior of the core. The magnified appearance of a fault of this nature is represented in Fig. 1, where *a* is the conductor, *b* the insulation, and *c* the impurity causing the fault. In the example shown, the foreign matter, such as a fragment of wood, for example, is represented as forming a direct path from the conductor. A less prominent case is denoted at c' where the impurity is totally imbedded in the insulating sheath; this would, in all probability, not become apparent as a decisive fault, but rather make itself felt in a local reduction of the insulation resistance, owing to the lesser thickness of the otherwise uniform insulating sheath.

Now, as to how these impurities find their way into the insulating medium:—Ordinary dirt and impurities may be generally accounted for by insufficient washing and mastication, but minute splinters of wood, for instance, may be accounted for in a different way. The rubber, previous to its application to the conductor, is in the form of rolls of sheet, mounted on a cylindrical wooden mandrel in a lathe, for the purpose of cutting it by means of a knife tool into rubber tape of varying widths, in which condition it is applied to the cable or wire; if the tool be advanced too deeply into the thickness of the roll its extremity reaches the wooden core, and in all probability cuts it slightly, the subsequent splinters, if the wood be soft, being commingled with the last layer of rubber. This cause of fault has been eradicated in many factories by making the cores of hard wood and dispensing with the final six inches, or so, of rubber tape, when running through the machine, an additional safeguard being provided in the shape of a stop to limit the depth of penetration of the cutting tool.

Fragments of metal, copper, tin, etc., are frequently separated from the conductor itself in the following manner:—The smaller sizes of strands and single wires generally are covered with rubber by compression, *i.e.*, the conductors, together with two strips of rubber one above and the other below, are passed between pairs of accurately turned hard steel rolls, which are grooved semi-circularly, such that at the point or line where they meet and revolve against one another, they form a complete circle equal in area to the cross-section of the finished or rubber-coated core. The seam or junction is secured to perfection by that property of freshly-cut rubber surfaces known as cohesion. Now, it is obvious that to secure centrality of the conductor it must pass absolutely through the centre of the circle formed by the groove in the two rolls; this is generally secured by passing it through frictionless guides, and also by maintaining the wire or strand taut between the limits of the machine by means of tension devices. Notwithstanding these precautions, it frequently happens in the case of stubborn wires or strands, such as 1|12 or 7|14 for example, that a slight kink in the bare conductor will pass between the rolls unnoticed, the existing tension being insufficient to straighten it. In a mild case, this usually results in throwing the conductor out of centre, as represented end-on in Fig. 2, such that the insulation is very thin on one side and correspondingly thick on the other, which has an obviously deleterious effect upon the ultimate insulation resistance of the core.

In extreme cases, however, as with a bad kink, the periphery of the conductor itself passes at one point between the contact surfaces of the rolls, and is squeezed out into a species of metal fin, surrounded on all sides by rubber, but usually with its extreme edge exposed, as represented in longitudinal section by Fig. 3, where *a* represents the conductor as before, *b* the insulation, and *c* the fault.

Fibrous impurities, such as cotton, jute, etc., frequently occur, and, absorbing moisture by capillary attraction, provide direct conducting paths from the conductor to the exterior.

Another frequent cause of fault is the cohesive seam before alluded to, which requires to be subjected to perfect compression by two meeting surfaces to ensure its satisfactory production. If the rolls by which it is produced be not accurately surfaced and re-turned from time to time, the wear and tear consequent on frequent and daily use causes them to become untrue, with the result that they do not actually meet, and the subsequent seam is in consequence imperfect, and tends to open again at that point instead of becoming, as in the case of a perfect seam, homogeneous with the remainder of the insulating sheathing.

This cause may be practically eliminated by systematic inspection and overhauling of rolls, as now adopted in the leading cable factories.

A very frequent cause of local weakness in insulation is the absence of pure rubber

at certain points along the core. The pure rubber, which is the first coating applied to the conductor in vulcanized rubber-covered cables and wires, is especially in the smaller sizes, responsible for a considerable percentage of the ultimate insulation resistance, and, if conspicuous by its absence, tends to lower the final megohmic result obtained. This absence of the coating is explained as follows:—The pure rubber takes the form of a very thin coat applied spirally to the conductor under tension, *i.e.*, it is stretched in position, each turn or lap overlapping the last by an amount sufficient to produce a perfect homogeneous joint by the aforementioned property of cohesion. If the rubber should give way at any point through inherent weakness or careless jointing, its natural elasticity causes it to run back for a short distance, and so leave the conductor exposed. A bare portion of the conductor exposed in this manner may pass over unnoticed by the attendant, and receive its subsequent coating of compound rubber, which hides the original fault until it is exposed by the subsequent electrical tests. For this reason, what is known as a "double lap" of pure rubber, though slightly more expensive in prime cost, gives much better results, in that any spaces left by the first coating are almost invariably covered by the second layer. This cause of fault has now been almost entirely removed by a rigid system of visual inspection of the unfinished core both entering and leaving the machine.

A very common manufacturing fault met with in vulcanized rubber-covered cables is that caused by a flattening of the insulating sheath due to excessive pressure while in a plastic state. Most compound rubbers before vulcanization are more or less of the consistency of putty, and, consequently, if subjected to any excessive weight or pressure, tend to flatten and lose their circular conformation. In order to undergo the process of vulcanization, the taped core is wound on cylindrical metal drums, which are then placed in the vulcanizing receiver. If an excessive length of core running into several layers, be wound on these drums, the upper layers tend to press and contract on the underneath ones, thereby producing a flattening of the insulation, which—the rubber being then in a plastic state—becomes permanent, and, in extreme cases, causes the conductor to become exposed by sinkage through the surrounding rubber. Two faults of this description are represented in transverse section in Fig. 4, *a* being a mild case, and *b* an extreme one.

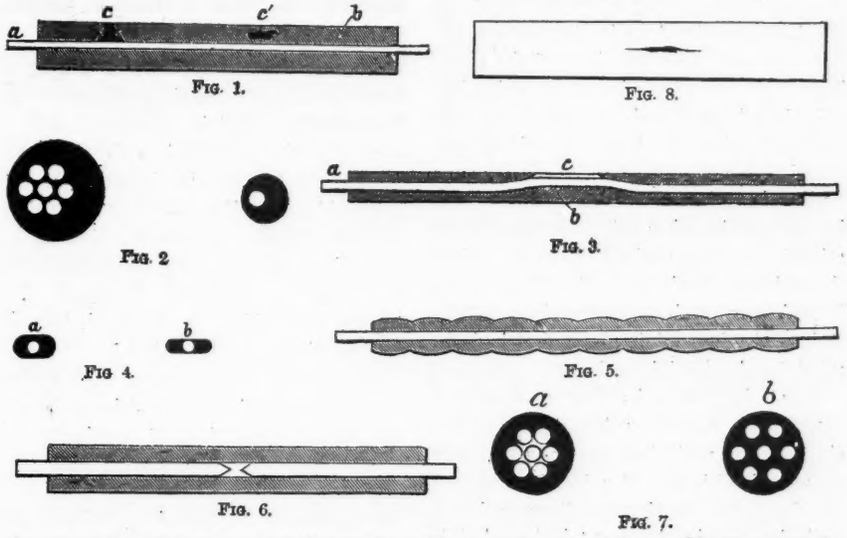


Fig. 1.

Fig. 8.

Fig. 2

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Diagrams Illustrating "Some Interesting Faults met with in Cable Manufacture."

The taping, previous to vulcanization, is also frequently responsible for certain faults, of which the following are typical specimens:—The "proofed" tape is applied spirally to the rubber-covered core under mild tension from a rapidly rotating "head." The tension is regulated by a nut and friction washer on the bobbin spindle; and if this be too tightly adjusted it causes the tape to draw in at its edges, and, by excessive pressure, cut into the surface of the plastic unvulcanized rubber, producing a fault, illustrated to a slightly magnified degree in longitudinal section by Fig. 5.

A second taping fault which the writer has met with was due to the jointing of the tape, where one bobbin ran out, and another started. This jointing is sometimes effected by the application of a slight touch of pure rubber solution, or, in other cases, by hammering the two "proofed" surfaces together on a flat base, and trusting to cohesion to secure the joint. The fault under consideration was caused by the former method, in which a somewhat liquid solution had evidently been employed to excess; the overplus of naphtha, or other solvent, had in this case dissolved a large portion of the rubber immediately beneath the tape join, and thereby pitted the insulation in such a manner as to render it defective. Similar faults were experienced in this particular length of core at almost every tape joint.

Another result of tight taping is what is technically known as "spewing" of the rubber, which consists in the plastic rubber forcing its way under pressure of the encircling tape through the interstices of the fabric, and assuming a bead-like formation on the exterior surface of the core; in this manner the true thickness of the insulation is diminished, and its insulating qualities thereby impaired.

Broken wires and strands, especially in the smaller sizes, are a constantly recurring source of trouble in cable manufacture, mainly owing to the fact that almost all cable machinery is started and stopped on the "fast" and "loose" pulley system, a very erroneous one, under the circumstances, for this class of work. Almost all cable machinery, whether rubber-covering, taping, braiding, compounding, or armoring and serving, has a tension device of some kind, acting more or less directly on the cable attached to it, and the result of a sudden start on a hitherto stationary conductor can be better imagined than described. Numerous faults arise from this cause alone, large cables, having a conductor diameter of .5 inch or even more, being broken in this manner. In the case of small single wires, provided the shock be not very great, the broken extremities of the conductor are frequently held in intermittent contact by the inherent elasticity of the encircling rubber, which remains undamaged, thus giving greater trouble in localization. The sectional appearance of a fault of this description is represented by Fig. 6.

Breaks in small single wires are often the result of overheating or burning in jointing, the copper at that point being thereby rendered "short" or brittle. For a similar reason the use of an acid flux in soldering electrical conductors is tabooed, as the smallest trace of such a flux remaining on the finished joint will in time exercise a corrosive action on the metal thereof, tending in most cases to ultimate severance of the conductor, or, in any case, to the introduction of a high electrical resistance at that point.

Another form of fault which is occas-

ionally met with in stranded conductors, especially when the conductor is of that particular quality technically known as "hard drawn," is that due to what is known as "bird cageing," which consists in a general tendency on the part of the component wires to unstrand, causing them to bulge out of their normal position and engulf the surrounding insulation. The appearance of a normal and "bird-caged" strand of seven wires is represented in transverse section by *a* and *b*, Fig. 7.

Lead sheathing, which is so universally adopted as a mechanical protection for electric cables and wires, is responsible for several faults. In fibre-insulated cables, the imperviousness of the lead sheathing is the only guarantee of quality, in that a pinhole, extending through the thickness of the sheathing, will ultimately develop into a fault by the entry of moisture at that point. Such pinholes and flaws are frequently caused by the presence of minute quantities of red lead in the bulk of the metal, which passes through the press and ultimately presents the appearance of a small crack or flaw in the surface of the lead as represented in Fig 8.

Other manufacturing faults in the lead sheathing process result from over-heating of the metal, etc., and frequently lead to the destruction of the actual insulating material while passing through the press.

The above-mentioned faults represent only a small percentage of the many which arise in process of cable manufacture, and are the result of observation on the part of the writer at some of the leading cable factories. They are in many cases responsible for the delay in execution and delivery of cable contracts, being, in the majority of cases, unforeseen, or due to carelessness on the part of the operatives. In some cases the fault lies with the customer, who, for the sake of a few shillings, will insist on a large single conductor or other erratic specification of his own personal conception instead of accepting the standard designs which have stood the test of time. In the writer's opinion, 1|14 is the safe limit for a single conductor; after that size is passed, stranded conductors should invariably be employed; they are more flexible, easier to manipulate, and carry a more reliable guarantee of quality than a single conductor of equivalent cross section.

A special committee of citizens has been appointed by the city of Lincoln, Neb., for the purpose of securing estimates and figures on putting in and operating a municipal electric light plant for that city. It is understood that Mayor Winnett, of Lincoln, is at the head of the movement and all information may be obtained from him.

Election Returns by Telephone.

The New York Telephone Company made very complete arrangements for distributing election returns over the telephone system of Manhattan and the Bronx and Westchester County. The American Telephone and Telegraph Company (long-distance) collected the returns from the various local telephone companies all over the country and compiled summarized bulletins which were turned over to the New York Company for distribution. In Westchester County the New York Telephone Company collected the information for that district as well as distributing the returns for the whole country.

For receiving and distributing the statistics a large number of special telephone sets had been fitted up in the new operating room on the ninth floor of the Cortlandt street telephone building, which has only just been completed and is not yet equipped with the monster switchboard building for it. On one side of the room the returns from all over the country came in, and on the other side they were transmitted to the various Central offices throughout Manhattan, the Bronx and Westchester, and to the various hotels, clubs and other public places that had applied for the special service.

Any telephone subscriber who desired information regarding the progress of the election, on notifying the operator, was connected with one of a hundred special telephone stations that had been equipped in the Thirty-eighth street telephone building for the purpose of answering such inquiries.

In 32 of the principal hotels and clubs in Manhattan the New York Telephone Company provided members of its own staff for receiving and tabulating the bulletins as they came in, and the returns were also supplied to 35 of the country clubs, associations and hotels of Westchester County.

This very complete service was supplied entirely gratuitously by the New York Telephone Company, which, realizing the excellent facilities its system affords for quickly and effectively distributing the returns, has done similar work at each election for several years past. The telephone system has had such an enormous growth during the last few years, however, and the interest in this election was so intense that the latest arrangements were on a much larger scale than ever before. The special services of some 400 employees of all departments were required apart from the regular complement of operators and others at their ordinary posts.

Mr. W. D. Sargent, general manager of the New York and New Jersey Telephone Company, extended invitations to a number of the leading citizens of Brooklyn to hear the election returns at the new telephone offices of his company, at 81 Willoughby street. There was a large attendance of ladies and gentlemen, and a very pleasant social evening was spent, refreshments being served about 10 o'clock. The returns came in very promptly and were received with much evidence of satisfaction. The telephone subscribers throughout the city of Brooklyn were enabled to receive the news of the result over the telephone promptly, and this facility was very generally patronized.

Death of the Hon. William L. Strong, Ex-Mayor of New York City.

William L. Strong, former Mayor of New York city, formerly president of the Brush-Swan Electric Company and a man actively identified with the large business and industrial interests of this community as well as with a successful reform movement in politics, died at his home, in New York city, on November 2, in the seventy-third year of his age. His funeral was held at St. Thomas's Church, in New York, on November 5.

Mr. Strong was in many ways typical of the best in American citizenship and was one of a long line of merchants and men of affairs who have started with small beginnings and lived as object lessons of the opportunity afforded to honesty and industry in this country. He was born in Ohio, his parents moving thence to Connecticut, and his business career commenced at the early age of 13 years. His early manhood was spent in Ohio, he having returned to New York city when about 26 years old. From that time his career was marked by practically unbroken success. The firm of W. L. Strong & Company became well known in the drygoods world and the private fortune accumulated by Mr. Strong has been estimated at very high figures. Becoming deeply interested in municipal affairs, Mr. Strong began to take an active part in them, and in 1894 was elected by a large majority as mayor of New York city on a non-partisan reform ticket. Many resolutions of regret were passed by various mercantile and other bodies when the news of his death was made public and his funeral was largely attended by delegates from such bodies as well as representatives of most of the important industrial interests in the city.

Permission has been granted to the Southern Bell Telephone Company by the city of Tuscumbia, Ala., for the stringing of telephone and telegraph wires and the establishing of a telephone exchange.

Science Brevities

Action of Sunlight on Lead Peroxide—Herr Schoop has recently stated that electrolytic peroxide of lead is reduced by direct sunlight, and supported the assertion by the following experiment. He coated a sheet of soft lead with a paste made of peroxide of lead and sulphuric acid, left it to dry in the air, and then cut it into three portions, one of which he exposed to direct sunlight, another to diffused daylight, while the third was put in a dark place. After the lapse of some hours he found that the color of the two samples exposed to light had altered considerably, the hue of that which had been exposed to direct sunlight having turned to a foxy red, and this change of color Herr Schoop attributed to a change in the chemical composition of the lead peroxide, says the *Electrician*. In the opinion of Dr. Peters, expressed in the *Centralblatt für Accumulatoren und Elementenkunde*, this change of color can not be taken as a proof of change in chemical composition, for in the course of experiments on the formation of Planté plates he tested the correctness of Herr Schoop's assertion. Dr. Peters took two lead plates which had received an electrolytic coating of peroxide, washed them in running water while protecting them as far as possible from the action of light, and dried them in the dark. One of these plates, *a*, was left in the dark, while the other, *b*, was exposed for two to three days to daylight, 36 hours to 40 hours of which was direct sunlight. The hue of the plates became lighter, although not to the same degree as noticed by Herr Schoop, and this change of color depends on the thickness of the peroxide layer, which was probably thinner in Herr Schoop's experiments than in those conducted by Dr. Peters. At the expiration of the time named the amount of lead peroxide on the plates was determined by a titration method, to be described later, and it was found from the result of several analyses of the two plates that plate *a* which had been kept in the dark contained a lower percentage of peroxide than plate *b* which had been exposed to the light, which seems to show that sunlight has no chemical action on lead peroxide, and that any lightening in hue of the peroxide plate which takes place is due to some physical cause, or to an alteration in the molecular groupings rather than to any change in chemical composition. With reference to these experiments on the effect of direct sunlight on lead peroxide, it will be remembered that Mr. R. E. Crompton in 1890 called attention to the fact that secondary batteries which were exposed to strong light had not the same capacity as those which were not thus exposed, and that those negative plates which were most exposed to sunlight or to the action of the arc light gave off hydrogen most rapidly, so that it would appear that light has some action on the electrolyte even if it does not affect electrolytic peroxide when dry.

A New Telegraphone—An improved telegraphone for demonstration purposes is described by Herr E. Ruhmer, his description being thus abstracted by M. Fournier d'Albe: The steel band on which the records are made is wound on four rollers arranged in a rectangle, and the winding is so arranged that the band is continuous, and for a reproduction of the record it is not necessary to reverse the band and start it again, but simply to let it run on. The cores of both the recording and reproducing magnets are parallel to the breadth of the band, and not perpendicular to its surface. They are made to touch it. For the guidance of the wires, four brass combs are mounted near the rollers. The whole apparatus is driven by a one-sixteenth horse-power electromotor, which imparts to the band a velocity of 3 metres per second. The duration of speech is two minutes. That is not much for a phonograph, but, of course, it can be increased by increasing the number of rollers or the distance between them. Several hearing magnets can be arranged, and if it should be necessary to repeat a short passage that can be done by mounting a hearing magnet on another part of the wire, and switching it on as required. The author mentions a German sentence, giving the same words when reversed, which he has successfully reversed on this apparatus. It is: "Ein Neger mit Gazelle zagt im Regen nie."

Interference Films by Electrolysis—Mr. S. A. Vaughton, says the *Electrician*, has given particulars of some rather pretty experiments he has devised and performed recently. He took a dish containing dilute sulphuric acid, placed in it as anode and cathode two pieces of sheet aluminum, and passed a strong current for a few minutes. He then found that the "water-line" of the anode had become strongly irridescent. He explains this after performing another experiment. The anode, while in a sloping position, is about one-third immersed in the bath and its upper surface is kept moistened by the gentle dripping of dilute sulphuric acid upon it. A current from six Bunsen cells is passed for 8 or 10 minutes, hydrogen being evolved at the cathode, but practically no gas being given off at the anode. The anode is now found to exhibit a series of wide horizontal bands of color which pass several times through a perfect spectrum as one glances down the plate. These bands are not destroyed by the greatest possible heating, and, when examined by the aid of a Nicol, proclaim themselves as produced by interference at the two surfaces of a film. Weak acids and ammonia have no effect on the colors, but caustic soda solution destroys them. Mr. Vaughton concludes that the colors are due to the deposition on the aluminum of alumina films of gradually-increasing thickness produced by the nascent oxygen liberated by the electrolysis at the anode.

Glow in Vacuum Tubes—If the influence of heat upon the electric glow in a gas is to be determined it is not advisable to heat the whole tube, as in that case the conditions of discharge are totally changed. Herr J. Stark therefore employs a looped carbon filament, with its plane normal to the axis of the tube, carefully insulated, and rendered incandescent by an independent current. To avoid justifying Lehmann's supposition that the dark space observed around the glowing body is a dark cathode space due to an independent discharge, the author works with a high-potential continuous current rather than an induction coil. All the results point to the theory that a simple increase of temperature stops the luminosity of a gas under an electric discharge. Hittorf's idea that this is due to a stoppage of the phosphorescence is hardly tenable in view of the dark spaces observed at ordinary temperatures. The probable explanation is that the increase of temperature brings about an increase in the conductivity, and a consequent reduction of the potential gradient. This, says an *Electrician* abstract, is corroborated by the fact, known for some time, that in a stratified discharge the dark portions are the portions of minimum potential gradient.

Long Island automobilists have incorporated the two most important clubs on the island for the purpose of securing road rights and other privileges. The officers of the new association reside in Brooklyn and will establish headquarters for their clubs, which, before the consolidation, were known as the Automobile Club of Brooklyn and the Long Island Automobile Club.

Electric Lighting

The city of Ilion, N. Y., has recently issued $30,000 worth of bonds for the erection of an electric light plant.

A municipal electric light plant is being discussed by the citizens of Middletown, N. Y., who have voted $10,000 in bonds for that purpose.

The city council of Gaffney, S. C., has recently voted an additional bond issue of $15,000 for increasing the city's electric light and water facilities.

Samuel H. Vandergrift's fine new yacht Cherokee is to be equipped with a fine electric light plant and fitted with a searchlight of high efficiency.

The Ithaca Electric Company, Ithaca, N. Y., has recently been incorporated for $50,000. The company will generate electricity for light, heat and power.

About 100 new arc lights are to be placed at different points in the city of Columbus, Ohio, under the direction of the city council's light committee.

A complete duplicate plant has been decided upon by the San Diego Gas and Electric Light Company, of California, at a cost of $25,000 and a capacity of 380 arc lights.

Oklahoma City, Okla. Ter., will soon have 26 additional street lights, and the electric light company has already begun to string the 20 miles of wire required for that purpose.

A franchise has been granted to private enterprise in Laurel, La., for the construction and operation of an electric light and power plant, the primary object being the lighting of the town.

A bond issue of $25,000 has been made by the authorities of Ruston, La., for erecting an electric lighting and waterworks plant in that city. Mr. R. M. Adams is the engineer in charge.

An offer of $80,000 for the local electric light and water plant of Kokomo, Ind., is being considered by the company's officials, and the town authorities are inclined to believe that the offer will be accepted.

The Valley Falls, Kas., electric light plant has been purchased by a local promoter, who will make important improvements in the service and who expects to install 500 lights, his specialty being to illuminate private residences.

A bond issue of $1,750,000 is soon to be made by the Birmingham, Ala., Railway, Light and Power Company, which expects to expend the amount in improvements to its system.

Plans have been completed in the Indian Office, Washington, D. C., for an electric light plant and its equipment for the Chilocco Indian School, near Arkansas City, Ark., and tenders for the construction work will soon be advertised.

A franchise has been asked for by local parties for the erection and operation of an electric light plant in Delray, Mich., with the conditional clause that the plant may be sold to the authorities at any time within six years after April 1, 1901.

An application was recently filed with the common council of Oshkosh, Wis., for an extension of its street railway franchise and the contract for the city lighting, the franchise expiring in July, 1903, and the lighting contract sometime during the present year.

A purchase of land and water rights has been made on the banks of Miller's River, near Athol, Mass., by the Athol Street Railway Company, which will erect an electric lighting plant there, costing in the neighborhood of $6,000.

The Sidney Electric Light Company, of Sidney, Ohio, has obtained the contract for lighting that town for a period of 10 years, the conditions of the contract being that public places, the council chamber and the fire department shall be furnished with free lights.

Sealed proposals accompanied by certified checks for five per cent of the amount of the proposal and made payable to C. D. Reed, clerk of the village of Waynesville, Ohio, will be received by him until noon, November 13, for the construction of a water and light plant in that village.

The charter has been applied for at Jackson, Miss., by the Southern Electric Light & Power Company, of Vicksburg, which will be capitalized at $100,000. The company will build, control and operate electric, gas and power plants throughout the south and it is stated that a Chicago capitalist, Mr. J. C. Schaefer, is at the head of the movement.

An increase in its facilities is contemplated by the electric power plant at Folsom, California, three large transformers having been placed and new switchboards, which were ordered some time ago, are being set up. When all arrangements are complete, it is estimated that about 1,000 horse-power will be added to the capacity of the plant, which will then develop 1,000 volts.

It is stated that the Stavanger corporation of Stavanger, Norway, is inviting bids for the establishment of electrical communication or power transmission from the Altesrig water falls to Stavanger, a distance of 24 miles. It is understood that the scheme will require considerable water-power transmission machinery.

The General Electric Company, of Schenectady, N. Y., has purchased the entire plant equipment of the Capital City Electric Light Company, of Des Moines, Iowa. As the General Electric Company already owns the Des Moines Edison lighting plant, it is intended to consolidate the two and have but one company, thus doing away with the competition.

A contractor of Cornwall, Ont., has begun the development of the unlimited water supply at Sheik's Island and will light Cornwall canal and transmit power to the city of Cornwall. All this he expects to do by having a canal 200 feet long and 20 feet deep. At the lower end of the canal, on the level of the lake, will be placed apparatus for conveying the water through the turbines to the power house. The turbines will be of 3,000 horse-power each and the power house will be built large enough for the development of 4,000 horse-power.

A somewhat amusing though disastrous exhibition of fireworks was recently caused by the crossing of the electric wires at the terminal poles of the Minneapolis, Minn., General Electric Company in the rear of Temple Court, in that city. The fire engines were immediately called and began to play upon the conflagration. Water seemed to have little effect, as the wires continued to shoot out sparks and keep up a brilliant illumination. A large crowd somewhat hampered the firemen and had considerable amusement at the latter's efforts to extinguish the blaze, but when they succeeded in putting it out they were greeted with a burst of applause.

Permission has been granted to the Edison Electric Company, of Cincinnati, Ohio, to open the streets of that city for the purpose of laying or removing tube feeders, but not to lay conduits. The permission is conditional upon 10 rules laid down by the board of public service to protect the public against inconvenience while the work is going on, and while the matter of opening and replacing the portions of the streets required is left to the engineer, the other parts of the work which relate to electrical matters have been put in charge of the city electrician. The city will require a bond of $20,000 from the company for the proper fulfillment of the work.

THE ELECTRICAL INDUSTRIES ASSOCIATION.

NEARLY 5,000 ELECTRICAL WORKERS TAKE PART IN THE SOUND MONEY PARADE.

So far from dampening the enthusiasm and ardor of the Sound Money paraders on Saturday last, the rain seemed only to increase the enthusiasm, making the parade a huge success; from about nine o'clock in the morning until six o'clock at night over 100,000 men tramped through the muddy streets, cheerful and good-natured, in spite of the inclement weather.

The part played by the Electrical Industries Association in this event is notable for two reasons: First, that they turned out nearly 5,000 men; and, second, for the excellent arrangements which were made, enabling the organization to hold together and present a fine appearance in spite of the difficulties presented. To Mr. H. L. Shippy, the marshal, and Major Robert Edwards, Jr., his experienced chief of staff, is due largely the credit for the successful carrying out of the arrangement and order of the different organizations in the electrical division of the parade, and the laying out of a complete plan with military precision. This gave sufficient time to the chiefs of divisions and subdivisions to understand thoroughly the order in which they were placed, and exactly how the marshal wanted the details arranged. Much credit is due also to Mr. A. P. Eckert, who acted as assistant chief of staff, and to the several gentlemen, among them Mr. Alfred F. Moore, of Philadelphia, and two of his fellow townsmen, who acted as marshal's aides. The various committees on music, flags, badges, etc., all did efficient work, though the flags and badges, which had been provided to the number of 4,300, gave out before the division started on account of the unexpectedly large turnout of men.

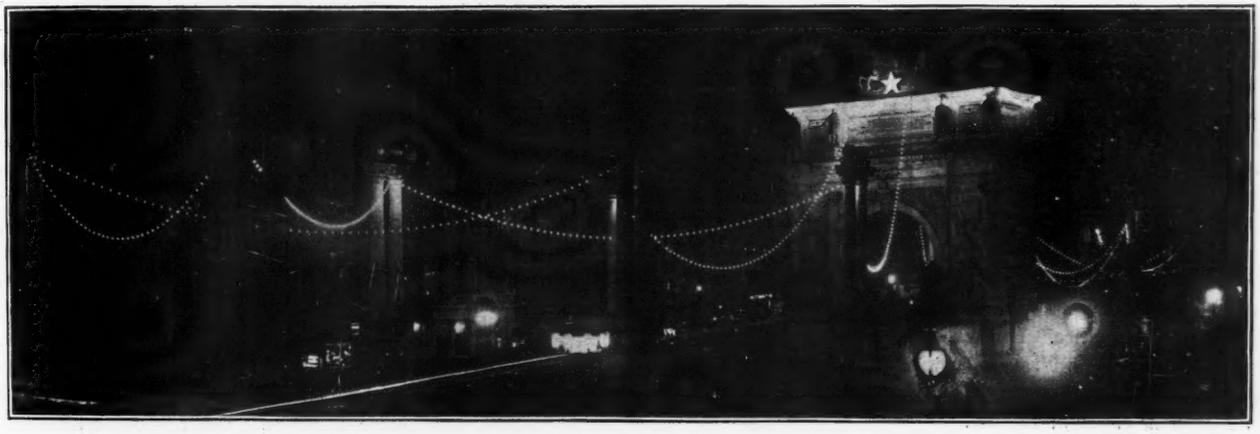
Starting the formation in Dey street, west of Broadway, the organization composing the electrical division began to form about two o'clock, and from that time until half-past three, when the brigade started, the men stood chaffing and joking in a rain and cold wind that at other times would have been calculated to sour the sweetest temper, but only good-nature was manifest on this occasion. The military experience in the National Guard of various of the officers of the association proved of inestimable value, enabling them to foresee and forestall the difficulties which would otherwise have been hard to surmount.

Consisting of five divisions, five bands and a drum corps, the brigade comprised, in round numbers, 5,000 men, and included all the principal electrical manufacturers and supply dealers, with an automobile division of 256 men. Promptly on time the organization left Broadway and Dey street, marching up Broadway, turning into Fifth avenue at the Washington Arch, passing the Naval Arch, where it was reviewed by Governor Roosevelt and others, and proceeding up to Fortieth street, where the disbanding of the organization was skillfully managed by the marshal and his aides. Among the aides were the most influential electrical men in New York, including representatives from the principal electrical organizations and the press.

Prominent among the organizations parading were those from the Western Electric Company, about 1,600 strong, under command of Mr. Russell; from the Crocker-Wheeler Company, 500 strong, under the command of Dr. S. S. Wheeler; from the Sprague Electric Company, 400 strong, with Mr. A. C. Blakewell in command; from the Safety Insulated Wire and Cable Company, nearly 300 strong; from the Okonite Company, the Manhattan Electrical Supply Company, the Dale Company, the New York Telephone Company, the General Electric, Bunnell Electric, Westinghouse Electric, Edison Illuminating, Eddy Electric, Bishop Gutta-Percha, Bullock Electric and many other electrical and supply companies. The Sound Money Telegraph Club turned out about 300 men.

To Mr. E. S. Keefer, president; Mr. A. S. Bakewell, vice-president; Mr. George L. Patterson, treasurer, and Mr. H. B. Kirkland, secretary, of the Electrical Industries Sound Money Association, are due much of the credit of the success of the undertaking—a success all the more marked when the weather conditions are considered.

Taking it altogether, the feature of the parade represented by the electrical workers was one not soon to be forgotten, showing as it did a large increase in the field and the readiness of the men to support the movement.



ELECTRICAL ILLUMINATION OF THE DEWEY ARCH, NEW YORK CITY, DURING THE RECENT POLITICAL CAMPAIGN.

Business Troubles.

Judge Freedman, of the Supreme Court, has appointed Francis N. Sanborn temporary receiver of the American Impulse Wheel Company, of No. 120 Liberty street, New York, on application of the directors, in proceedings for the voluntary dissolution of the company. The company was incorporated in December, 1896, with a capital stock of $20,000. Bonds to the amount of $25,000 were afterward issued, and it is said that about $75,000 was expended in building up the business. The company manufactured high-pressure water-wheels and hydraulic machinery in connection with electrical transmission of power from water. The liabilities are $51,198 and the assets, $17,428.

Wall Street and the Electrical Stock Market.

Owing to the coming elections the lively spirit of the stock market this week has somewhat abated, and the active and buoyant speculation which prevailed in October has been replaced by contracted dealings and sagging prices. The declines, however, have not been extensive, and as the period of suspense is drawing to a close the money market seems to be at a standstill awaiting with unabated confidence the result of this all important issue.

On the New York Stock Exchange, General Electric closed the week at 141½ bid and 142½ asked, showing a loss of 1½ points. Metropolitan Street Railway, of New York, closed at 158½ bid and 159 asked, indicating a loss of 2 points for the week. Third Avenue Railroad, of New York, closed at 108 bid and 110 asked, showing a loss of 2 points. Brooklyn Rapid Transit closed at 61 bid and 61⅜ asked, showing a loss of 1⅛ points. Manhattan Railway, of New York, closed at 96¼ bid and 96½ asked, indicating a loss of 1⅛ points for the week.

On the Boston exchange, American Telephone and Telegraph closed the week at 147 bid and 147¾ asked, indicating no change in the bid price. Erie Telephone closed at 98 bid and 100 asked, showing a loss of 1 point for the week. New England Telephone closed at 123 bid.

On the Philadelphia exchange, Electric Storage Battery was not quoted. Electric Company of America, closed at 10¼ bid and 10⅜ asked, showing a gain of ¼ point for the week. Union Traction closed at 34¼ bid and 34½ asked, indicating a gain of ⅛ point.

On the curb, or outside market, in New York, Electric Vehicle closed the week at 18 bid and 20 asked, showing a loss of 1 point. Electric Boat closed at 19 bid and 21 asked, indicating no change in the bid price and a gain of 1 point in the asked price.

Wall street, November 3, 1900.

An Electric Fan Patent Suit.

A suit for infringement has been filed by the Emerson Electric Manufacturing Company, of St. Louis, Mo., against the Van Nort Brothers Electric Company, of the same city, the statement being that the latter firm sells alternating-current ceiling fans made by the Dayton Fan Motor Company, of Dayton, Ohio, which is said to have infringed patents belonging to the Emerson Electric Manufacturing Company.

A Rail-Bond Infringement Suit.

On October 20 papers were filed in the suit of the American Steel and Wire Company against the Mayer & Englund Company for alleged infringement of patents owned by the former. Three patents are involved in the proceedings and a valuable precedent has been established for the complainant in the decision handed down in its former suit against the Eureka Tempered Copper Works, which enjoined that company from the further manufacture or sale of any rail bond infringing the Keithly patent, which is owned by the American Steel and Wire Company.

The patents concerned are known as the Daniels and Keithly; the wording of the former covers rail bonds consisting of two terminals with a flexible body between them secured or welded to the ends of the body and made substantially integral therewith by pressure. In addition to this is the Keithly patent of 1894, this being three years older than the other. It protects "a railbond composed of a rod, bar or wire, having tubular or thimble-shaped terminals and secured to electrical conductors by having the tubular or thimble-shaped terminals permanently expanded by stretching or swaging of the metal composing them into contact with holes in the conduits."

On this patent was based the first suit against the Eureka people, who made their bond under the McLaughlin patent, the decision being that the latter infringed upon the Keithly patent and was therefore void. In the present instance the Mayer & Englund Company is selling the "Protected" rail bond, which is alleged by the American's officials to infringe both its patents and the manufacture and sale are carried on in the face of the decree granted in the Eureka case. An injunction will be asked for.

More Wireless Telegraphy Experiments.

A press despatch from London states that successful experiments with Marconi's system of wireless telegraphy were made on the night of November 3 from the mail boat Princess Clementine while she was steaming from Ostend to Dover. The first demonstration was made while the steamer was actually passing the mast erected on the land at La Panne, between Ostend and Dunkirk. Constant messages were sent to and fro at the rate of 20 words a minute until Dover, which is 61 miles distant, was reached.

The Citizens' Independent Telephone Company has been granted a franchise for 21 years at Oklahoma City, O. T., and will put in a $30,000 plant.

TELEPHONE SERVICE FROM MESSENGER CALL-BOXES IN NEW YORK CITY.

There will shortly be installed, as a supplement to the messenger call-box service of the American District Telegraph Company in New York city, a large number of the instruments illustrated in the accompanying engraving which combine the functions of a call-box with those of a telephone. It is believed by the company that the great advantages possessed by this variety of instrument will cause it entirely to supplant the ordinary call-box within a short time after its introduction upon subscribers' lines.

The instrument consists of a base-board upon which, in a circular case, is mounted the usual mechanism of a call-box operated by the lever shown on the right-hand side. This call-box is of the ordinary break-circuit type usually employed by the company, its mechanism consisting of a train of wheels actuated by a spring which is wound up by pressing the lever, and which moves a toothed disk or sector under contact springs so as to interrupt the continuity of the circuit in a predetermined way and send in a call, consisting generally of a combination of three numbers of taps separated by short intervals. The call-boxes have usually been placed about 50 in series on loop circuits radiating from and returning to district messenger offices which are scattered about the city in large numbers. The new apparatus will contain, in addition to this mechanism, a telephone transmitter and induction coil, which is mounted inside the case, a receiver hanging upon a spring-hook so connected with the mechanism of the call-box that lifting the telephone from its hook causes the call-box to be set to work. A third terminal is supplied to each box connecting the telephone mechanism to ground through push-buttons placed respectively on each side of the instrument. In case of an open circuit on the loop, by pushing one or the other of these buttons communication may still be maintained with the district office.

The telephones are worked upon a common battery system, the batteries for the operation of the various circuits of a district office being assembled there and none being required in subscribers' premises. It has been often noticed that, notwithstanding the perfection and efficiency to which the American District Telegraph Company has brought its call-box and messenger system, in some cases serious difficulty ensues from the physical inability to answer calls sent in from a box instantaneously. It is always necessary, under

the present system, when one wishes a messenger for any purpose, to wait until the boy can cover the distance between the district station and the premises upon which the box is located. With the new system the answer from the district office is practically instantaneous, the subscriber being in immediate communication with a clerk there when he has removed his telephone from the hook. In this way, orders for service may be conveyed directly from the subscriber to the district office, and these orders may cover all manner of wants, from such simple ones as the desire to know the time of day up to emergency calls for police, fire apparatus, physicians or what not. Indeed, practically any household need can thus be telephoned to the district office where attention will be given it and the important service of the uniformed messenger boys will doubtless be greatly extended by the use of this instrument.

The instrument itself is known as the autophone and is made by the National Autophone Company, of Chicago. As it is to be installed at present, it will be noticed that it consists of a one-way telephone—that is, the subscriber can call the central office but the instrument is not provided with bells or other methods of indicating a call from the central office to the subscriber; hence its use, for the present, will be limited to messages originating with the subscriber and terminating (as telephone messages) in the district office, whence messengers can be sent to perform such services as are desired. Two or three circuits of these instruments have already been put in place connecting with the main office of the company at 195 Broadway, New York city, and these are said to have given great satisfaction already. While the instruments are not of the non-interfering type, the signaling of the central office by means of a second instrument on the circuit while one is in use in no way interferes with conversation. Mr. M. W. Rayens, the general superintendent of the American District Telegraph Company, states that it is expected to have a large number of the instruments ready for installation in a few weeks and that, while a charge will be made for their use, it will be only nominal.

What the future plans of the company will be in regard to the use of these instruments can not at present be stated. While it is claimed that there is no immediate intention of installing interconnecting switchboards at the district offices, still it is not denied that these can be put in and worked effectively. If this were done it would make the district messenger call system a telephone exchange system of large proportions. There are at present in New York city no less than 30,000 messenger call-boxes in service and 85 district offices.

AUTOMATIC TELEPHONE AND CALL-BOX TO BE USED BY THE AMERICAN DISTRICT TELEGRAPH COMPANY, IN NEW YORK CITY.

PERSONAL.

President John M. Roach, of the Union Traction Company, of Chicago, Ill., emphatically denies the rumor that he is to leave Chicago and assume control of the Brooklyn Rapid Transit after its consolidation with the Metropolitan Street Railway Company, of New York. When Mr. Roach was questioned regarding the matter, he intimated that he knew nothing of it whatever and had no intention of leaving Chicago. He is now on a trip to Florida where he has erected a handsome Winter home.

Mr. A. K. Baylor, who for some years was prominently connected with the electric railway department of the General Electric Company, and later was manager of the British Thomson-Houston Company, of London, has established an export business in American electrical apparatus with New York offices in the Bowling Green Building, New York city. Mr. Baylor has also recently formed, at Manchester, England, the British Electric Car Company, Limited, which proposes to manufacture electric railway cars in the rough upon the designs and lines which have proved so successful in the United States, and to finish them in accordance with the demands of European purchasers and operators.

Electric Railways

An electric line, 45 miles in length, is to be built from Iberia to Berwick City, Mississippi.

The power house of the Truckee River, Cal., General Electric Company will be opened on October 20, and the power used to run the Gould & Curry and the Comstock mines.

A report from Ocean Grove, N. J., states that the Middlesex & Somerset Traction Company has secured a franchise through Madison township and expects very shortly to extend its lines from South Amboy to Keyport.

The franchise of the Chillicothe, Mt. Sterling & Columbus, Ohio, Street Railway Company was declared forfeited recently by the county commissioners, because the company did not begin operations within the prescribed time.

Dayton, Ohio, capitalists are interested in a proposed line from Circleville to Columbus. They intend to build on private right-of-way as far as possible and will only use the public roads where it is absolutely necessary. The line will almost parallel the Norfolk & Western steam railway.

The directors of the Cherry Hill, Elkton & Chesapeake City, Pa., Electric Railway Company, whose incorporation was recently noted in these columns, state that the entire capital stock, $150,000, has been paid in, principally by Philadelphia capital, at the head of which are Messrs. Thomas Deegan and M. P. O'Brien.

Construction work has already begun upon the trolley line which will extend between Mechanicsburg and Churchtown, Pa. The work has begun at Mechanicsburg and it is expected that the cars will be running by December 1. When the line is completed it is expected that the expenditures will amount to about $300,000.

The Southern Ohio Traction Company, which has absorbed all the different lines between Cincinnati and Dayton, will begin the operation of through cars between those points very soon. The distance of 51 miles will be covered with half-hour service. It is claimed that this will be the longest continuous electric road in the West.

Allegheny, Pa., will shortly have a new road which will run from the city line, on Perryville avenue, follow a circuitous route through the town, and end where it begins. It will also operate a branch line which will run over the People's Traction Company's tracks and will connect with the Union Traction Company's lines.

A report from Watervliet, Mich., states that rights-of-way, sites for termini and a franchise for an electric road to run from South Haven to Pawpaw Lake, have been obtained by a Chicago capitalist, who will not only build and operate the road but also proposes to establish an electric light plant to illuminate the towns of Watervliet and Coloma.

Suit has been brought and a verdict obtained against the Metropolitan Street Railway Company, of New York, for $37,000 by Elizabeth Rhoads, administratrix for her husband, Captain George B. Rhoads. It is stated that this is the largest verdict ever recovered for a fatal injury, as, until about five years ago, such actions were limited to $5,000.

For some time past injunctions have been in effect against the Swarthmore, Media and Middletown electric railways, in Pennsylvania, but at a recent hearing of the case the court decided that the injunctions were invalid and additional trolley facilities will soon be provided, which will permit the lines in question to have termini in Chester and connect with the city of Media and points in the vicinity.

It has been agreed by the city council of Birmingham, England, that after November 9 a committee, to be known as the Tramways Committee, shall be appointed to take over the powers and duties of the council's public works committee regarding the tramways. It is stated that as an indication of the amount of work the committee will be expected to handle, three companies in Birmingham easily receive 55,000,000 fares, their gross receipts aggregating £300,000 per annum.

One of the conditions of the franchise granted to the Schenectady, N. Y., Street Railway Company is that it must operate cars between Schenectady and Albany at stated intervals so that commuters to either city may pass back and forth between 6.30 and 7 o'clock, both morning and evening, of every week day. Another condition is that the construction of the road must begin within 30 days from the date of the franchise and be completed and in operation within one year.

New directors are shortly to be elected by the Brooklyn Rapid Transit Company, Brooklyn, N. Y., among whom will be financiers representing two large institutions in Brooklyn, an important Manhattan trust company, and the Metropolitan Street Railway Company. It is stated that at present there are "dummy" directors in the board of the company who will be replaced in the coming election, and rumor has it that among the men to be elected will be Messrs. William C. Whitney, Elkins, Widner and someone from the Standard Oil Company—possibly John D. Rockfeller himself.

Mr. G. F. Greenwood, chief engineer and general manager of the Havana, Cuba, Railway Company, who was recently released from quarantine at Hoffman Island, New York Harbor, has returned from Cuba to vote. He states that his company expects to begin operating trolley cars in and about Havana about February 1. One hundred cars will be run, each having a seating capacity of 32 passengers, and 3 power houses, the engines for which are being built in Milwaukee, are situated in the outskirts of Havana.

The Illinois Central Railroad Company, of Chicago, Ill., is erecting a new electric plant near the lake front, at Twenty-seventh street, which is theoretically to operate the road signals in the vicinity and light the stations, but it is rumored that it is really the first step toward substituting electricity as the motive power for suburban trains on that company's lines. An employee of the road says that as soon as the third rail system is perfected the road will immediately make preparations to change its motive power. He states, however, that the third rail system in use at the present time, if used in the yards of the company where switching is done, would probably kill a half dozen brakemen and passersby a day.

An interesting feature in the improvements in electric street railway machinery is the introduction of noiseless car wheels, with which one of the cars of the street railway system of Chicago, Ill., has been equipped. The construction of the wheel is chilled steel with a layer of paper between the tire and the wheel proper, a very simple but extremely effective expedient. It is also stated that when the tires are worn out, it is not necessary to press them off but simply to unbolt them from the paper connection on the outer rim of the wheel, when what is practically a new wheel is made by the replacing of the tire over five "points" of new paper, the weight of whole equaling that of a new wheel. The tires are secured by 12 machine bolts.

Electric Trolley and Traveling Hoists.

In many locations, such as shipyards, docks, large warehouses, etc., where materials are to be handled over considerable distances, an electric hoist of the trolley type—that is, one running along a suspended rail or rails—is found to be very useful. The accompanying illustrations represent some machines of this type recently put upon the market by the Sprague Electric Company, New York, Fig. 1 showing a side view of the trolley hoist.

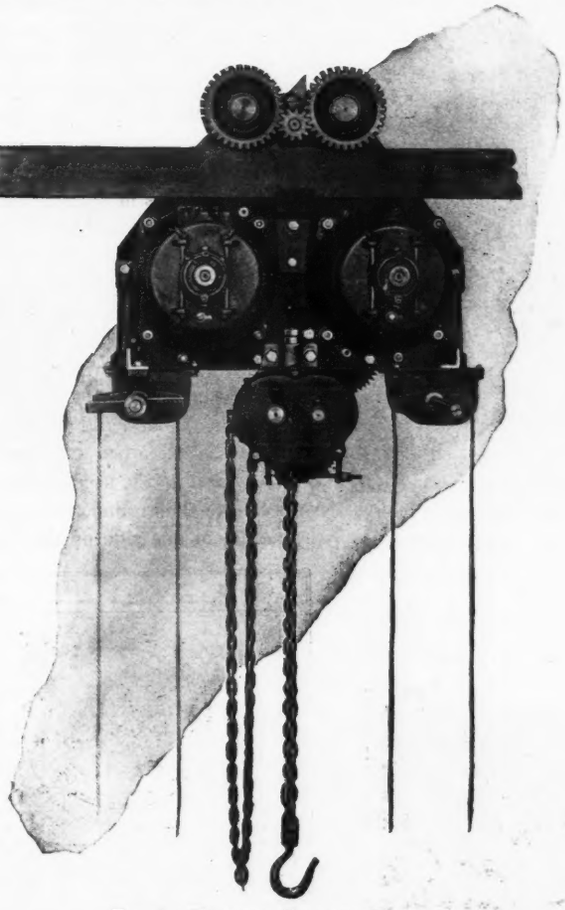


FIG. 1.—ELECTRIC TROLLEY HOIST.

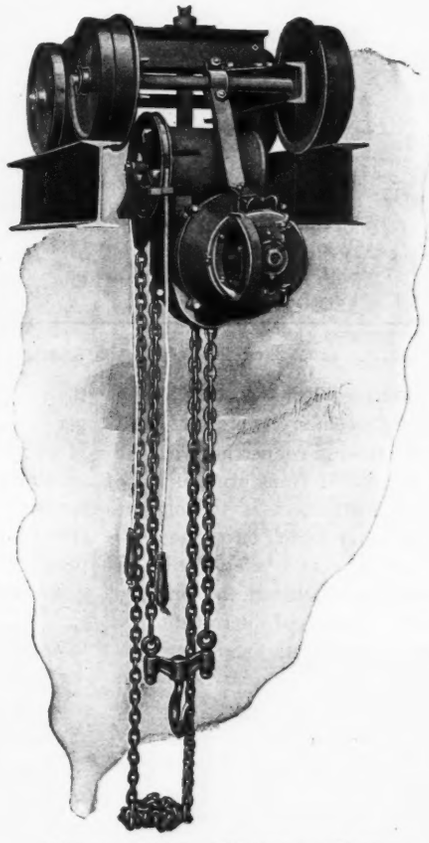


FIG. 2.—ELECTRIC TRAVELING HOIST.

The machine is provided with two Lundell enclosed motors, one of which is geared to the Harrington hoisting mechanism below while the other is connected to the traversing wheels above. Both hoisting and traversing gears are provided with electro-mechanical brakes, which are normally set and automatically released when the motors are put in operation. The control of the motors is obtained through the pendant cords or chains shown to the right and left, there being one cord for each direction of motion. They are arranged with automatic limit cut-offs which shut off the power when the limits of motion in each direction are reached. These machines are made in capacities up to 800 pounds, the speed of hoisting being about one foot per second for a 500-pound load. The traversing speed is six miles per hour. Motors are furnished for any standard voltage. The hoist takes its power through trolley wires in the ordinary way. In order to obtain quiet operation the pinions on the motors are of rawhide. The machine requires only seven inches head room above the track and very short curves can be turned.

Fig. 2 shows an electric traveling hoist made by the same company, the construction of which is easily understood from the illustration. The hoist is similar to that shown in Fig. 1. The controller, as well as the motor and hoist mechanism, is entirely enclosed and the apparatus is well-adapted to be used in the open air. This hoist will lift a load of 4,000 pounds. It is intended that this apparatus shall be put up on tracks of I-beams, 21 inches apart. No provision for traversing is made in it, this movement being accomplished by hand.

OBITUARY.

Charles A. Gundaker, who had charge of the sales of incandescent lamps and meters in the New York office of the General Electric Company, died at his home in Newark on Wednesday last, October 31.

The immediate cause of his death was peritonitis. Mr. Gundaker's connection with the electrical industry dates back to 1881, when he began work at Mr. Edison's lamp factory, at Menlo Park, he being then little more than a half-grown boy. The lamp factory had then been going a little over a year, having been started in 1880. From the lamp factory Mr. Gundaker was transferred to the New York office of the Edison General Electric Company in 1891, being placed in charge of lamp sales. After the formation of the General Electric Company, through the consolidation of the Thomson-Houston and Edison companies in 1893, Mr. Gundaker took charge of meters as well as lamps for the supply department of the New York office of the new company. He remained in that position until his death. Mr. Gundaker was a thorough master of all the details of his business, a good comrade, a first-class salesman and a man liked and respected by all who came in contact with him. Mr. Charles T. Hughes, the manager of the New York local office of the General Electric Company, was deeply grieved to receive word of Mr. Gundaker's death, breaking, as it does, a friendly link which has continued without interruption for almost 20 years. The funeral services were held in Newark on Friday evening, November 2.

Some Interesting Alternating-Current Accessory Apparatus.

A number of interesting accessory appliances designed particularly for use with alternating-current apparatus and manufactured by the Stanley Electric Manufacturing Company, of Pittsfield, Mass., are shown in the accompanying illustrations. Figs.

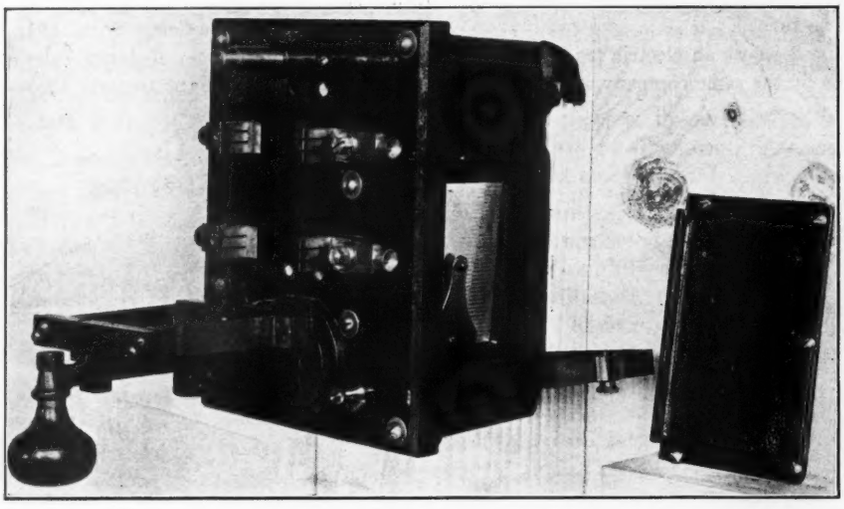


FIG. 1.—SECONDARY PROTECTOR FOR ALTERNATING-CURRENT CIRCUITS.

1 and 2 represent a new device called by the makers a "secondary protector," and intended to be used in connection with the secondary circuits of transformers. The object of the instrument is twofold; it acts as an ordinary switch on the secondary circuit and also as a safety device in case the insulation between the primary and secondary elements of the transformer is ruptured, admitting the main-line primary voltage to the secondary network.

The instrument consists, as the illustrations clearly show, of a two-pole knife switch solidly mounted upon a slate baseboard, which in turn stands upon a cast-iron case carrying the relay apparatus used when the voltage passes safe limits on the secondary circuits. Referring to Fig. 1, a plunger is shown at the top of the slate base, which, when the switch is closed, is driven back into the casing against a powerful spring and there held by a trigger connected with the armature of a solenoid installed in the case. Ordinarily, this plunger remains locked in place, but should the solenoid be traversed by a current and the trigger sprung, the plunger is violently forced out by the spring, throwing the switch open to the position indicated in Fig. 1, thus opening the secondary circuit on both sides. The solenoid is connected with an instrument resembling Cardew's earthing device, which is illustrated more in detail in Fig. 2. This illustration shows the cover removed from the box, containing a thin sheet of corrugated aluminum foil which normally remains suspended very near, but not in contact with a screw. Should the high primary voltage enter the secondary circuit the electrostatic attraction set up between the parts of this apparatus will close the powerful primary circuit through the solenoid, instantly springing the trigger and opening the secondary switch. It is stated that this instrument works admirably in practice, being highly responsive. Fig. 3 shows, in diagram, an electrostatic voltmeter made by the same company. This instrument is beautifully ingenious in its design and it is claimed that

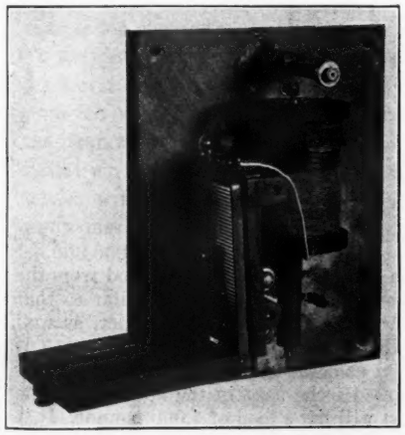


FIG. 2. EARTHING DEVICE OF SECONDARY PROTECTOR.

it is entirely shielded from the influence of magnetic fields or charges external to it.

A movable vane consisting of two light quadrants, *A A*, hangs in jeweled bearings and upon its shaft is fixed the pointer. Just outside of these movable vanes are four fixed vanes, *B B* and *C C*, of which two sets, *B B*, are connected together to one side of the circuit and to the movable vanes, while the other two fixed vanes, *C C*, are also connected together and to the other side of the circuit. The instrument is thus, in effect, practically a quadrant electrometer. All of the fixed vanes are imbedded in hard rubber which confines their charges and prevents them from leaking to other parts of the instrument. Thin fans, *F F*, running in the air dash-boxes, *D D*, render the instrument practically dead beat. At present these instruments are made for use on circuits ranging from 750 to 2,800 volts.

Fig. 4 represents a static ground detector which is constructed on much the same principle as the voltmeter described above and is also practically a quadrant electrometer. A peculiarity of this instrument, however, is that the full voltage of the primary current is nowhere in direct communication with the moving system or the stationary attracting system used. The circuit is not directly connected to these vanes, but they are charged from plates in inductive relation, through heavy slabs of rubber in the base of the instrument, with imbedded plates connected directly to the main line conductors and are thus charged by electrostatic induction. The movable vanes attached to the needle are, of course, connected to the ground, and deflection of the needle to one side or the other indi-

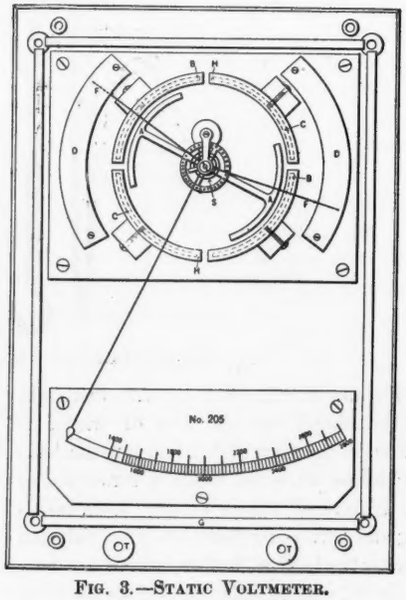


FIG. 3.—STATIC VOLTMETER.

cates a ground upon one side or the other of the line, the pointer naturally going toward the side which is grounded. It will be readily seen that it is not necessary to bring the primary voltage even to the base of the instrument, as the small condensers through which the electrostatic induction charging the fixed vanes takes place may be put anywhere that is con-

venient and conductors led from them to the ground detector. These instruments are made at present for circuits of from 500 volts up and, of course, like the voltmeter described above, are equally applicable to direct or alternating-current circuits.

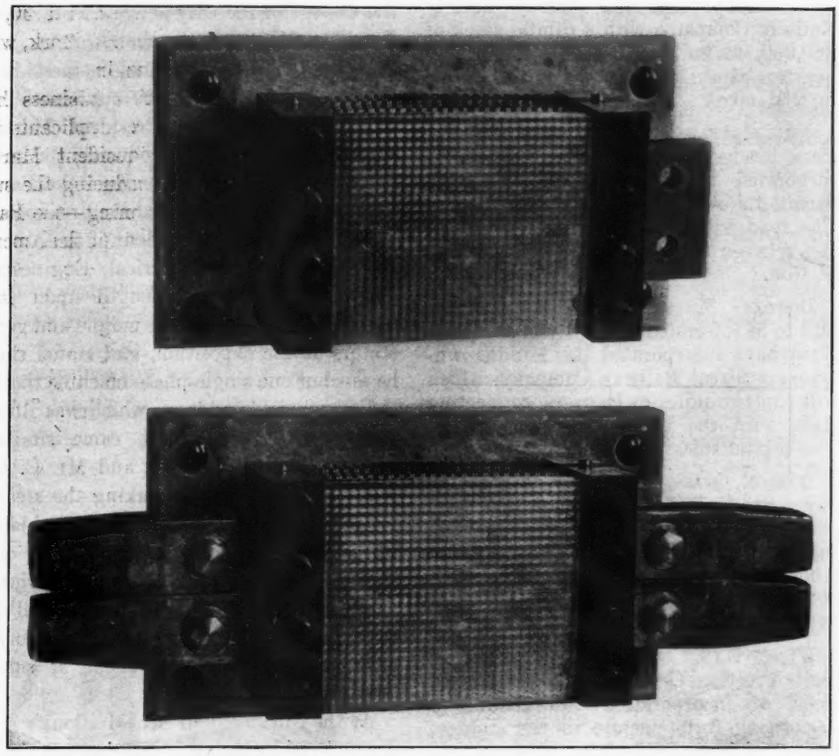


FIG. 5.—HEAVY SHUNTS FOR HOT-WIRE SWITCHBOARD INSTRUMENTS.

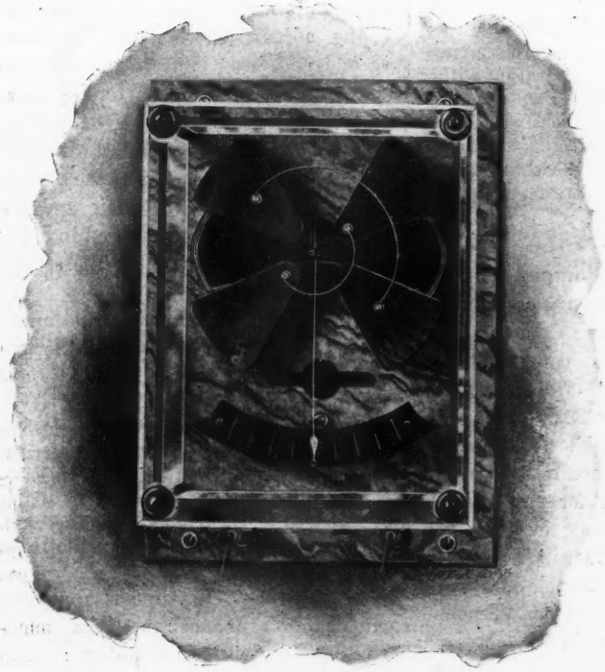


FIG. 4.—STATIC GROUND DETECTOR.

Fig. 5 represents two shunts for use with hot-wire ammeters for switchboard work which have been recently manufactured by the Stanley Company. The larger of these two shunts is intended to carry currents up to about 2,000 amperes. It is constructed of corrugated plates of "constatan" held between heavy copper terminals on a marble base. Fig. 6 illustrates an ingenious apparatus known as a line discharger, intended to be used in connection with lightning arresters and to remove even the slightest static charge from the line. It consists of a very minute air-gap in connection with a series of tubes filled with oxidized metallic shot. A tube 18 inches long and about three-eighths inch diameter filled with small shot that have been oxidized electrolytically has a resistance of about 50,000,000 ohms and any ordinary line current applied to its terminals will not force an appreciable current through it. This instrument is said to have found considerable use as a protection for underground cables, which often accumulate enormous potentials when the currents they carry are suddenly broken. The instrument may also be used to remove static charges from generators and belts. The above illustrations represent only a small proportion of the accessory apparatus for alternating-current work manufactured by the Stanley Electric Manufacturing Company, but give an excellent idea of the great detail with which this concern has worked out the difficult problems connected with the minutiæ of alternating-current application.

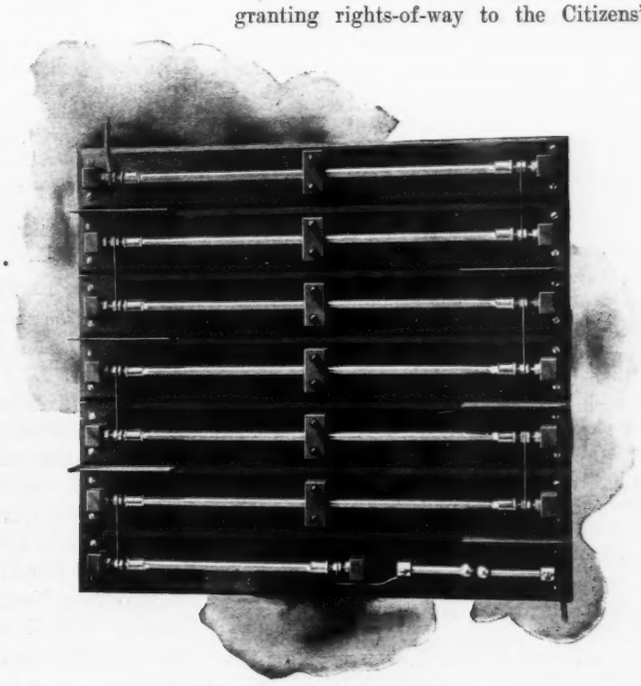


FIG. 6.—LINE DISCHARGER.

An ordinance has been passed by the city council of Oklahoma City, Okla. Ter., granting rights-of-way to the Citizens' Independent Telephone Company for 21 years. The ordinance was accepted by the company, which will commence work in about 30 days on its exchange at a cost of about $30,000.

Corporation News

LANCASTER, OHIO — The Lancaster Telephone Company has recently been incorporated for $100,000.

AMHERST, OHIO—The Amherst Home Telephone Company has been chartered by local capital for $25,000.

OELWIN, IOWA—Outside capital has incorporated the Oelwin Light, Heat and Power Company for $100,000.

ALBANY, N. Y.—The Whitehall Gas and Electric Company has been incorporated by New York and Whitehall capital for $50,000.

NEW ALBANY, IND.—Local capitalists have incorporated the Automobile Cab Company, of New Albany, for $35,000 capital stock.

DOVER, DEL.—A $25,000 corporation, known as the White Motor and Machine Company, of Waltham, Mass., was recently chartered at Dover.

SHAMOKIN, PA.—Incorporation articles have been granted to the New Castle & Sharon Street Railway Company, which is capitalized at $150,000.

ST. LOUIS, MO.—A recent incorporation under Missouri laws is the Scott Automobile Company, of St. Louis, which has been chartered for $30,000.

MINNEAPOLIS, MINN. — The Blood-Mille Motor Vehicle Company, of Minneapolis, has been capitalized for $500,000 in 5,000 $100 shares, by local promoters.

MAUCH CHUNK, PA.—A recent incorporation is the Carbon County Telephone and Telegraph Company, which has been chartered with a capital stock of $30,000.

LITTLE ROCK, ARK.—Incorporation articles were recently filed by the American District Telegraph Company, of Arkansas, in Little Rock. The company is capitalized at $10,000.

INDEPENDENCE, IOWA—Among the incorporations of recent date is that of the Buchanan County Telephone Company, which has been chartered with a capital stock of $50,000.

BUFFALO, N. Y.—Among recent incorporations at Dover, Del., is that of the International Rapid Transit Company, which has been capitalized at $1,100,000 by Buffalo promoters.

MOUNT VERNON, ILL.—Papers have been filed for the Mount Vernon Electric Light Company's certified increase in capital stock of $5,000, thus bringing the figures up to $25,000.

BRENHAM, TEX.—An increase of $5,000 to its capital stock has been voted by the directors and stockholders of the Texas Telephone Company. This increase brings the capital up to $10,000.

SIOUX RAPIDS, IOWA—The Sioux Rapids Telephone Company, which has been doing a general telephone business, has been incorporated with $10,000 capital stock by promoters of that city.

ALBANY, N. Y.—Capitalists of Albany have incorporated the Albany County Railway Company, with a capital stock of $20,000, to build an electric line three-quarters of a mile long on Central avenue in that city.

NEW CASTLE, PA.—Philadelphia financiers, headed by W. R. Wright, have incorporated the New Castle & Sharon Street Railway Company for $150,000. The road will be 20 miles in length and run between the towns of New Castle and Sharon.

BOSTON, MASS.—Capitalists who are said to be interested in the Lynn & Boston Road have incorporated the Middletown-Danvers Street Railway Company, which will run two miles to Danvers, connecting there with the Lynn & Boston system. The capital stock is $32,000.

BOSTON, MASS.—The Haverhill & Andover Street Railway Company has been chartered for $80,000 and will run from the Ward Hill Station, in Haverhill, to Andover, connecting with the Lawrence & Reading Line. At that point the road will be seven and one-half miles in length.

HICKSVILLE, OHIO—The Indiana & Ohio Traction Company has secured articles of incorporation and certificates permitting it to operate in the state of Ohio. It is capitalized for $750,000 and will begin construction work on the Ohio end of its lines immediately after the election.

HARRISBURG, PA.—The Turtle Creek & Millstown Street Railway Company has been granted articles of incorporation with a capital stock of $6,000. An electric light and power plant, which will cost about $100,000, will be erected at Harrisburg and the line itself will extend from Larimer and Osborne streets, Turtle Creek, to the village line.

A New Lighting Company.

Incorporation articles have been granted to the Westchester Lighting Company, of Port Chester, N. Y. The company was chartered with a capital of $2,500,000, $500,000 of which is preferred and the balance common stock. Electricity and gas will be manufactured and supplied by the corporation for public and private lighting throughout the state of New York. Headquarters will be established in New York and branch offices in Yonkers, New Rochelle, Mount Vernon, and other cities and towns in Westchester County.

The directors of the company are: Charles U. Squire, Charles H. Warner, R. T. McKiniry, Nathan D. Daboll, M. J. Warner, and Reginald H. Giles, of Manhattan, and Lewis B. Grant, Charles M. Heminway, and Henry A. Kenworthy, of Brooklyn.

New York Electrical Society.

The New York Electrical Society held its two hundred and eighth regular meeting on Tuesday evening, October 30, at the College of the City of New York, with President Martin in the chair.

After the usual routine business had been transacted and the 27 applicants for membership accepted, President Martin made a few remarks introducing the subject appointed for the evening—the Paris Exposition—and presented the first speaker, Mr. Carl Hering, president of the American Institute of Electrical Engineers. Mr. Hering dwelt at length upon the prominence of three-phase motors and generators at the exposition, and stated that he saw but one single-phase machine there.

Following his address, which was illustrated by lantern slides, came similar speeches by Dr. Kennelly and Mr. C. O. Mailloux, Dr. Kennelly taking the steam features of the big fair as his subject, while Mr. Mailloux recounted the obstacles put in the way of the American delegates regarding the making official of the terms used for units of magnetic force and magnetic flux. He spoke at some length.

At the conclusion of Mr. Mailloux's address, President Martin thanked all three gentlemen for their speeches, complimented them upon the good work done at the exposition, and was about to declare the meeting adjourned when Mr. Mailloux rose and addressed him, asking that the usual formalities be waived for the occasion and that permission be given him to cast a ballot to elect Messrs. Hering and Kennelly honorary members of the society. This was granted by the chair and the gentlemen thus elected responded in a few well-chosen phrases, thanking the society for the honor.

The following programme has been laid out by the New York Electrical Society for the season of 1900-1901:

A Night at the Automobile Show. C. P. Steinmetz on Alternating Current Engineering. C. O. Mailloux on Electrical Europe of To-day. Dr. Louis Bell on Electric Illumination. Kempster B. Miller on Modern Telephone Engineering. Frank J. Sprague on Electric Railroad Work.

President T. C. Martin has appointed committees on finance, meetings, membership and constitution as follows:

Finance, Arthur Williams, chairman, C. O. Baker, Jr.; Papers and Meetings, W. C. Burton, chairman, S. L. Coles; Membership, F. V. Henshaw, chairman, S. L. Coles; Constitution and By-Laws, Arthur Williams, chairman, H. A. Sinclair, G. H. Guy.

Telephone and Telegraph

In Handsboro, Miss., a telephone system about eight miles long will be constructed by private individuals in the near future.

The Paris Telephone Company's system, Paris, Ky., has been purchased for $9,000 by the Columbian Telephone Company, of Nashville, Tenn.

Poles have been set for the new long-distance telephone line from Briggsville, Wis., to Portage, and the line will be in operation in a few weeks.

A Long-Distance Telephone Desk Set.

A concern known as the Audubon County Telephone Company, of Des Moines, Ia., has been incorporated for $25,000 by local capitalists.

Trustees of the villages of River Grove and Wheeling, Ill., have granted the right to erect lines in their jurisdiction to the Chicago Telephone Company.

A telephone system for Florence, S. C., is being agitated by E. L. Moore, of Dillon, the president and general manager of both the telephone companies of that city.

Incorporation articles have been filed at Delevan, Wis., for the State Long-Distance Telephone Company, whose capital is $25,000 and whose main office will be located in Delevan.

The common council of Norfolk, Va., has granted the privilege to the American Telephone and Telegraph Company of erecting and maintaining its lines in the city of Norfolk.

The city solicitor of Alliance, Ohio, has filed a petition in the court of common pleas attacking the validity of the franchise granted the United States Telephone Company in that city.

An exchange will be established in Greenville, Mo., in the near future by the Cumberland Telephone and Telegraph Company, whose franchise has recently been granted by the local authorities.

The town of Frankfort, Ohio, is to have of Chillicothe. It will also have constalled by the Independent Association, of Chillicothe. They will also have connections with all the independent lines over the state.

The Silver City, N. M., exchange of the Grant County Telephone Company has recently been increased in capacity by 100 instruments. This addition was found necessary on account of the greatly increased number of subscribers on the company's books.

Officials of the Cumberland Telephone Company, who have recently been touring the system of the Tennessee Telephone Company, have stated that the purchase of the latter has been consummated and that extensive improvements will be made to the combined property.

A contract for the erection of a telephone exchange with a capacity of 10,000 subscribers at first which may be increased to 30,000 has been granted by the municipality of Buda-Pesth, Hungary, and it is expected that foreign engineering firms will eventually secure the work.

Messrs. W. Henderson and J. Davis, of Ridge Farm, Ill., recently closed a deal with the Danville Telephone Company, securing a controlling interest in that concern and will operate that line in consolidation with their other systems at Ridge Farm and points in the vicinity.

Colonel John P. Martin, of Xenia, Ohio, who is engineering the Cincinnati-Springfield Traction line, says work will begin this Fall. The line will be 72 miles in length and it is estimated to cost $2,500,000. It will pass through Loveland and 11 intermediate towns to Jamestown.

The Ohio Central Traction Company, which now operates an electric line between Bucyrus and Galion, Ohio, has decided to extend its line from Galion to Crestline, on the east, and from Bucyrus to Upper Sandusky on the west end of the line. The estimated cost of these extensions is $205,000.

A contractor of Baltimore, Md., has received a contract from the Maryland Telephone Manufacturing Company for the erection of a modern brick building of eight stories, to have all modern improvements, at a cost of $18,000. This new plant will replace the one which was destroyed by fire some months ago.

It is stated that the telegraph system in the Yukon Valley will be completed as far as Tanana by Christmas and the line from Dawson northward to Eagle on the American side will be completed in a month, so that only the distance between Eagle and Tanana will remain unconnected. When this is done Nome will be connected with the outside world and the 800-mile stretch will have been bridged.

The following statement is taken from the columns of the *Morning Citizen,* of Lowell, Mass.: "President Charles J. Glidden, of the Erie Telephone system, says that he fully appreciates the courtesy extended to him in mentioning his name in connection with the presidency of the American Bell Telephone Company, and that, should he be honored with an offer of the position, he could not accept, as his entire time is taken in connection with the Erie system, the continued success of which will be the height of his ambition."

A Long-Distance Desk Telephone.

The accompanying illustration represents a form of desk telephone intended for use in exchange work yet sufficiently powerful to operate well on long-distance or toll lines, and which is claimed by its manufacturer, the Century Telephone Construction Company, of Cleveland, Ohio, to combine several features of novelty. It is fitted with a long-distance transmitter of the granular carbon type and of new design, recently illustrated in these columns, and a double-pole receiver. The switch-hook is said to be very positive and effective in its action and is so substantial that its makers believe it will be impossible for it easily to be put out of order. The instrument may or may not be furnished with a generator and extension bell, as desired. All of the metal parts exposed are nickel-plated and the upright part of the stand is covered with polished hard rubber.

The Berliner Patent.

The final arguments and briefs in the case of the Berliner telephone transmitter patent were submitted to Judge Brown, in the United States Circuit Court of Appeals for the southern district of Massachusetts at Boston about a year ago. As the case has been so long under consideration it is expected that a decision will be rendered very shortly.

Industrial Notes

THE AMERICAN BRIDGE COMPANY is furnishing, from its Minneapolis plant, the structural steel for the roof of the state hospital at Glenwood, Iowa.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., has recently issued a new bulletin illustrative and descriptive of railway generators and boosters.

THE ELECTRIC APPLIANCE COMPANY, of Chicago, Ill., has been appointed selling agent in the western territory for Partrick, Carter & Wilkens's annunciators.

THE BURT MANUFACTURING COMPANY, of Akron, Ohio, manufacturers of the Cross oil filter, has just received a duplicate order from the Carnegie Steel Company.

THE CHICAGO GENERAL FIXTURE COMPANY, Chicago, Ill., is issuing a comprehensive catalogue of the electric, gas and combination fixtures which it manufactures.

THE SIEGRIST LUBRICATOR COMPANY, of St. Louis, Mo., has received the contract for equipping the entire plant of the Lacombe Electric Company, of Denver, Colo.

THE NEW ENGLAND ENGINEERING COMPANY, Waterbury, Ct., is now carrying in stock a supply of the Beardsley malleable iron pins and brackets for line construction work.

THE L. C. SHARPE MACHINE WORKS, Omaha, Neb., manufacturer of Sharpe's commutator clamp, says that it will send its book, "How to Build Commutators," to every purchaser of the clamp.

THE SCULLIN-GALLAGHER IRON AND STEEL COMPANY, St. Louis, has increased its lighting plant and placed a contract with the Western Electric Company, Chicago, for one 100-kilowatt generator.

THE SPRAGUE ELECTRIC COMPANY, of New York, has issued its Bulletin No. 203, describing its electric trolley hoist and electric traveling hoist, both of which are the most modern and improved machines the company can turn out.

THE COLUMBIA INCANDESCENT LAMP COMPANY, St. Louis, Mo., has recently sent out a neat blotter illustrating its 16-candle-power, 110-volt incandescent lamp. The blotter is neatly printed in red, white and green and will be sent free upon application.

THE SUTRO COTTON MILL COMPANY, of Yorkville, S. C., is installing an electrical plant for the lighting of its mills and the streets and stores of Yorkville. The order for the transformers and alternators has been given to the Royal Electric Company, of Peoria, Ill.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS, Scranton, Pa., have issued a syllabus of their courses in arithmetic, geography, civil government, etc., giving also the synopses of the courses described in electrical and mechanical engineering and kindred subjects.

THE L. B. ALLEN COMPANY, 1335 Columbus avenue, Chicago, Ill., reports particularly large orders for its soldering stick, soldering paste and soldering salts. These compounds, the manufacturer's specialties, are generally considered as very convenient and satisfactory for the purpose for which they are designed.

THE ENGINEER PUBLISHING COMPANY, Cleveland, Ohio, announces that Messrs. W. R. C. Smith and C. H. McMahan, who were formerly the western managers of the *American Electrician* and the *Street Railway Journal*, have severed their connections with those papers and have associated themselves with the *Engineer*.

THE GARL ELECTRIC COMPANY, of Akron, Ohio, has recently perfected two new types of telephone desk sets. One is designed for bridging or metallic circuit for long-distance service; the other is an intercommunicating instrument, which is designed for use in connection with the Garl intercommunicating system, and it is adapted for a 10-point system.

THE GREGORY ELECTRIC COMPANY, Clinton street, Chicago, Ill., has purchased the entire stock of the Siemens & Halske plant in Chicago. This includes dynamos, meters, motors, etc., and many other electrical devices. These are included in the "for sale" lists of the Gregory company's bulletin, which will be mailed upon application to intending purchasers.

FRED M. LOCKE, Victor, N. Y., manufactures a special type of the Locke high-potential insulators, known as No. 5, for street railway adaptation. These insulators carry up to 100,000 volts line pressure and the construction of the pin and insulator combines great strength with high insulating qualities making a very strong combination for holding large and heavy cable lines.

THE AMERICAN ELECTRIC FUSE COMPANY, Chicago and New York, reports a very large season's demand for fuses and fuse blocks, fuse wire, lightning arresters, telephone apparatus and kindred electrical specialties. This company now carries a complete stock in its New York store, 116 Nassau street, as well as the home establishment 345 South Canal street, Chicago, Ill.

THE JOSEPH DIXON CRUCIBLE COMPANY, of Jersey City, N. J., has issued a new folder descriptive of its silica-graphite paint for railway and other structures which are exposed not only to the weather but also to sulphur fumes and acid gases generated by combustion. It is claimed by the manufacturer to be superior to any other paint for railroad use, lasting longer and being more economical.

THE NAVAL ELECTRIC COMPANY, 95 Liberty street, New York city, is sending out a very attractive circular, describing its various apparatus for naval work, including several portable marine arc lamps, which have attracted considerable attention throughout the naval and steamship field. On the first page is an illustration of the lamp in operation, showing its adaptability for repairing work, etc., under water.

THE U. S. BATTERY COMPANY, 253 Broadway, New York city, is manufacturing U. S. storage batteries in five sizes. These batteries are of two and one-half volts and range from three to sixty ampere hours. This company claims that it is the only storage battery which is shipped charged, dry and with liquid in separate vessels. This company now operates branches in Chicago and Boston in addition to its large Brooklyn factory.

THE NATIONAL CONDUIT AND CABLE COMPANY, New York city, has received the following telegram from the consulting engineer of the St. Paul, Minn., Gas Lighting Company, referring to the three-conductor, paper-insulated, lead-covered cable, which was recently operated at a pressure of 30,200 volts: "Accept congratulations upon successful test at 30,200 volts, which I made to-day on your three miles of underground cable. Henry Floy."

MR. J. A. STILES, 141 Broadway, New York, has opened an office for representing several manufacturing companies in the capacity of sales manager for the Greater New York district. Mr. Stiles has been favorably known in the electrical field for several years and should meet with success. He wishes it announced that his office can accept the agency of one, or perhaps two, standard electrical lines in addition to its present agencies.

THE UNIVERSITY OF ILLINOIS has placed many orders for its electrical engineering laboratory. The machinery consists of polyphase rotary converters, transformers and regulators, induction motors and Weston instruments. This equipment will materially advance the university's facilities in its electrical department and those in charge are very complacent, as the number of students is largely increased and the machines will fill a much-felt want.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is devoting special attention to its line of alternating-current power motors. These motors may be operated on single-phase circuits or on one side of a two or three-phase circuit. They may also be run from the same circuit as lights and do not interfere with regulation of the lights when a transformer of the proper size is used. They are made in sizes ranging from one-tenth to two and one-half horse-power.

THE EUREKA ELECTRIC COMPANY, of Chicago, Ill., announces that its new "20th Century" catalogue is now ready for distribution. It illustrates and describes a very large line of telephone exchange switchboards, apparatus for centralized energy systems as well as magneto systems and all other devices necessary for the complete equipment of a high grade telephone installation, either for toll lines or an exchange. The company will be pleased to forward this catalogue, describing a great many new "20th Century" ideas, upon request.

THE WARREN ELECTRIC AND SPECIALTY COMPANY, of Warren, Ohio, one of the largest incandescent lamp manufacturers in the country, gave its customary annual banquet recently, covers being laid for 250 guests. It has been the custom of this enterprising firm to banquet its officials, employees and friends every year, the motto of the company being, as the secretary remarked at the recent spread, to "try to give you at all times a full dinner pail, and once a year, at least, a full bread basket." The affair passed off very pleasantly and after dinner was served a dance was given.

MR. L. B. MARKS, president of the Marks Enclosed Arc Light Company, of New York, has just received from M. Emile Javaux, the managing director of the Société Gramme, of Paris, a letter which may be translated as follows: "I have pleasure in informing you that the jury of Class 25 (of the Paris Exposition), in which your lamp was exhibited, has awarded you a gold medal. . . ." It will be remembered that Mr. Marks was one of the pioneers of the enclosed arc lamp, and this well-deserved recognition of his labors will not surprise those who have followed the remarkable progress of that device since its introduction.

THE ELECTRIC STORAGE BATTERY COMPANY, Allegheny avenue and Nineteenth street, Philadelphia, Pa., has prepared a neat circular illustrating the plant of the Woronoco Street Railway Company, Westfield, Mass., showing the battery room, switchboard and the generating plant. The object of the circular is to show the installation of chloride accumulators, which are said to be of special interest to such companies as operate small electric roads. The station equipment in this instance consists of two 75-kilowatt multipolar generators, and a battery of 264 chloride accumulator cells, type F 11, in glass jars, permitting an increase of 20 per cent on the addition of one pair of plates to each cell. On the last page of the pamphlet is shown a diagram representing the regulating effect of the storage battery giving the particulars of the total load, battery current and generator load.